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EXPERIMENT STATION

BULLETIN LVIII

SPRING GRAINS IN 1890

BY THOMAS SHAW PROFESSOR OF AGRICULTURE.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
February 2 1891

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BULLETIN LVIII

EXPERIMENTS WITH SPRING GRAINS.

The tendency with every variety of grain that has ever been produced is to deteriorate when grown long upon the same kind of soil and in the same locality. The necessity therefore for the introduction of varieties from other countries, or from distant parts of the same country, and of producing varieties which are entirely new, will always exist. In this fact we find a perpetual argument for the existence of experimental farms.

The object of this Bulletin is to make known to our farmers (1) the varieties of spring grains which grew most successfully at this farm during the summer of 1890, and (2) important comparisons relating to all the varieties grown. These comparisons relate (1) to yield, weight of grain, weight of straw and date of maturing in all the varieties mentioned, (2) to color and other peculiarities of growth, to the structure and weight of the grains, to the relative percentage of the hull and to proneness to injury from rust in some of the varieties named, (3) to the number of varieties tested from different countries and the average yields obtained from them, and (4) to six-rowed and two-rowed barleys respectively, with and without hulls.

The information thus given has been obtained from tests made with 54 varieties of barley, 54 varieties of spring wheat, 20 varieties of pease and 92 varieties of oats. The different varieties of each kind of grain were grown under similar conditions as to soil and treatment. They were sown side by side upon plots containing one-fiftieth of an acre each in the case of the barleys, one-sixtieth of an acre in that of pease, and one-hundredth of an acre in that of the spring wheat and oats.

In the tables given below the yields are based upon the standard weights obtained from the measured bushel, and from samples that were thoroughly cleaned.

BARLEY.—The information given in the first table relates to the ten varieties of barley which gave the highest yields in 1889 and 1890. The average yield is given for the two years. The varieties grown in 1889 were sown on April 15th and those of 1890 on April 19th.

Variety.	Kind.	Country whence obtained.	Bush. per acre.	Lb. of grain per bush.	Tons of straw per acre.	No. of grains per ounce.	Date of maturing.
Cheyne	2-rowed.	Germany.	48.5	53½	2.18	670	Aug. 6
Chevalier	2-rowed.	France ..	47.5	52⅓	1.13	726	" 7
Mandschuri	6-rowed.	Russia ...	47.3	51¼	1.70	755	July 31
Oderbrucher........	6-rowed.	Germany.	45.8	54¼	1.42	743	Aug. 1
Empress	2-rowed.	England .	45.4	51¼	1.92	720	" 6
Early Black	6-rowed.	France ..	44.8	51	1.61	591	July 31
Scotch Improved	6-rowed.	Ontario ..	44.4	52	1.27	805	" 31
Selected Chevalier...	2-rowed.	England .	43.0	50½	1.75	758	Aug. 7
Common	6-rowed.	Ontario ..	41.7	54½	1.29	819	July 31
Golden Drop	2-rowed.	Germany.	41.4	53½	1.84	646	Aug. 5

In addition to these, the following varieties went over 40 bushels per acre, viz.: Hallett's Pedigree (Germany), Phœnix (Germany), Italian Rice (Germany), and Imperial (France). Carter's Prize Prolific is not included in the above list as with us the average yield for the two years was 32.3 bushels per acre on the small plots and the return this year for the acre plot was 31½ bushels, and the weight for the crop of 1890 was 52 ℔. per bushel. It appears however to have done much better in many other localities.

SPRING WHEAT.—The information given in the second table relates to seven varieties of spring wheat which gave the highest yields in 1890. They were sown April 25th.

Variety.	Country whence obtained.	Bush. per acre.	Lb. of grain per bush.	Tons of straw per acre.	Rust tendency.	Date of maturing.
Herison Bearded..	France ..	27.2	64	1.90	Very slight...	Aug. 8
White Fyfe.......	Ontario..	26.9	60	1.39	Considerable.	" 14
Bart Trimenia....	Greece ..	26.3	64	1.06	Very slight..	" 10
White Russian....	Ontario..	22.1	57¼	1.91	Considerable.	" 11
Red Fern	Ontario..	21.9	60	1.76	Slight	" 11
Pringle's Champion	Germany.	21.2	59½	1.90	Very slight..	" 12
Holben's Improved	Germany.	20.4	58½	1.70	Medium.... .	" 14

The Herison Bearded has been tested for two years, and was last year ahead of all the foreign varieties and also of all the Canadian varieties except the Wild Goose. It is a fairly strong grower, stands up well and is almost entirely free from rust. The head is short but compact, and is bearded; the chaff is red and the berry is rather small but plump, and is also red. The Bart Trimenia, though a good yielder and weighs well, is rather coarse in the berry.

PEASE.—The information given in the third table relates to five varieties of pease which gave the highest yields in 1890. They were sown April 24th.

Variety.	Country whence obtained.	Bush. per acre.	Lb. per bush.	Tons of straw per acre.	Date of maturing.
Sweet Jessie	England	31.16	62¾	.82	Aug. 11
Early Racehorse.....	England .. .	29.29	64¼	1.06	" 10
Mummy	Ontario......	28.60	65¾	1.26	" 11
Early Britain........	England	28.37	60	.57	" 11
White Wonder	New Zealand.	27.67	64¾	.80	" 5

OATS.—The information given in the fourth table relates to the ten varieties of oats which gave the highest yields for 1889 and 1890. The average yields are given for the two years. They were sown on April 22nd of each year.

Variety.	Country whence obtained.	Bush. per acre.	Lb. per bush.	Tons of straw per acre.	Date of maturing.
Goanette Black	France...	71.7	34½	2.7	July 9
Houdan Black	France...	69.1	34¾	2.0	" 9
Chenailles	France...	69.1	34⅝	2.9	" 8
Oderbrucher	Germany.	66.6	31½	2.3	" 6
Danebrog	Germany.	64.0	32	2.7	" 9
Siberian...............	France...	63.6	34¾	2.1	" 2
Black Etampes..	France...	62.3	36½	2 5	" 9
Probsteier.....	Germany.	61.8	33	2.6	" 6
Pringle's Progress.. ..	Ontario..	61.8	28½	2.7	" 4
Improved Besthorne...	Germany.	61.8	32¼	1.9	" 9

It will be observed that all but one of these best varieties are foreign, although 21 varieties of Canadian oats were grown, including nearly all the old standard varieties. The average of yield of the ten varieties given in the table was 64.1 bushels per acre, while the average yield of the ten poorest was 27.8 bushels, that is, the ten good varieties yielded 230 per cent. more than the ten poor ones. It is also worthy of note that these good varieties all possessed the spreading head. The tendency to rust is slight in the first, third, fourth, fifth, seventh and ninth, considerable in the tenth and slight to medium in the rest. The color of grain in the first and second is pale black, the third and seventh black, the tenth yellow, and in the others white.

The Goanette Black, Houdan Black, Chenailles and Black Etampes are very much alike in all essential characteristics. The straw is strong and of medium height, or a little less. It stands exceptionally well, is not coarse and is almost entirely free from rust. They are somewhat inclined to shell easily when ripe, as is often the case with valuable grains. They also yield well and weigh well, and have a small percentage of hull as compared with the kernel.

AVERAGE YIELDS OF BARLEYS.—The average yields of barleys grown from seed obtained in the five countries named are as follows:

Country.	No. of varieties.	Bush. per acre.
Germany	17	35.6
England	13	42.2
France	7	37.6
Ontario	4	38.2
Sweden	4	33.5

AVERAGE YIELDS OF OATS.—The average yields of oats grown from seed obtained in the seven countries named in the table are as follows:

Country.	No. of varieties.	Bush. per acre.
Ontario	21	44.8
France	19	47.8
Germany	15	48.0
Scotland	13	41.8
England	9	41.8
Russia	5	42.7
Australia	4	32.6

TWO-ROWED AND SIX-ROWED BARLEYS.—The next table gives information regarding the 54 varieties of barley grown with and without hulls as to yield, weight of grain per bushel and the size of the grains.

Character of head.	With or without hulls.	No. of varieties.	Bush. per acre.	Lb. per bush.	No. of grains per oz.
Six-rowed..	With hulls ...	9	37.45	51.22	772
	Without hulls	5	31.00	61.80	848
Two-rowed	With hulls ...	39	37.84	51.87	685
	Without hulls	1	21.90	63.00	478

It should be borne in mind (1) that the average yields obtained in growing these grains is more than the average is likely to prove in the country generally, for they were all grown under very favorable conditions; (2) that similar weights are not likely to be realised unless the grains are thoroughly cleaned; and (3) that the facts in this bulletin will be valuable mainly in localities with soil and climatic conditions similar to those here. The soil where these plots were grown may be termed a mild clay loam, containing a considerable quantity of humus, and it is somewhat low in aspect. The average mean temperature for the past four years for the five months commencing with May 1st has been 61.43° F.

CONCLUSIONS.

The following conclusions may safely be drawn from the experiments which have been summarised above:

1. It is highly probable that some of the foreign varieties of barley named in the table will be found to give higher yields than the varieties now grown in Ontario when they have become more generally introduced.

2. It is probable that in some localities the Herison Bearded spring wheat will be found to be an improvement on many of the varieties that are now grown.

3. From present indications, based upon the trial given in the table and upon a trial on a larger scale on the farm, the Mummy pea is likely to become a generally useful variety, although the straw is not highly valued for feeding purposes owing to its coarse habit of growth.

4. That four varieties of French oats, viz., the Goanette Black, the Houdan Black, the Chenailles and the Black Etampes, are likely to prove of much value to the farmers of this province, as they

possess in common and in a marked degree nearly all the most valuable characteristics of oats. Their color will however discount them in the estimation of the oatmeal millers. The behavior of the Oderbrucher, also a white variety from Germany, has been such as to entitle it to the favorable consideration of the farmers. It has been most favorably recommended by the oatmeal millers.

5. Judging from the experience of the past two years the English barleys give on the whole the best results, but some fine growing and yielding varieties come from Germany and France. In reference to oats, the French varieties should be placed first, all things considered, although some kinds from Germany do nearly as well.

6. The average yields obtained from the two-rowed and six-rowed varieties of barley are not far different, nor is there much difference in the average weights of the two classes.

7. The average returns from the foreign varieties are in a majority of instances superior to those from the old standard varieties.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LIX

GREEN FODDER FOR SWINE

BY THOMAS SHAW PROFESSOR OF AGRICULTURE

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
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BULLETIN LIX.

GREEN FODDER FOR SWINE.

This experiment began on June 7, 1890, and closed October 8, covering a period of 123 days. The after experiment growing out of it lasted 40 days. Its primary object was to ascertain whether green fodder used as a food adjunct in summer along with a suitable meal ration effected a saving in the cost of producing pork, and if so to what extent. A second object was to ascertain whether a large or a small quantity of the green food used in this way furnished the cheaper ration. A third object was to test the correctness of the theory advanced by some scientists, which claims that some bulky food mixed with a meal ration in feeding swine secures a more thorough digestion of the meal, since it prevents impaction of the same in the stomach.

THE ANIMALS SELECTED. The animals selected for the experiment were pure Berkshires and Berkshire grades, all bred upon the farm. There was one of the former in each group. The grades were by a pure Berkshire sire, out of a high grade Berkshire dam, and the pure breds were by the same sire. They were divided into three groups. Each group comprised three animals, two of which were barrows and one a sow. The individual animals in each group were from different litters, and one animal in each group was in every instance from the same litter. These litters were farrowed September 11, November 25 and December 1, 1889, the pure breds being the oldest. They were all in good store condition at the commencement of the experiment.

PERIOD OF PREPARATION. For one week before the experiment commenced, the pigs in the different groups were put upon the ration fed during the experiment. Before that time they had been fed very similarly on meal and refuse from the college.

FOOD AND FEEDING. The pigs in group No. 1 were fed all the meal they would take without waste. Those in group No. 2 were fed about three-fourths as much meal as the pigs in group 1, and also a quantity of green fodder. The pigs in group 3 were fed about one-third as much meal as those in group 1, and about twice as much green fodder as those in group 2. The aim was to make the quantities of meal used in these two instances exactly two-thirds and one-third respectively of the amount fed to the pigs in group 1, but slight variations were caused by the consumption by the latter of quantities of meal not always the same from day to day. When definite changes were made in the quantities of food fed, they were always made at the weighing periods, which were every two weeks. The meal ration consisted of ground pease, two parts; ground barley, one part; ground oats, one part, and wheat middlings, one part. These proportions were by weight. The green food consisted of clover, oats and vetches, corn and millet, as these came in season. It was cut into lengths of about one-half-inch by running it through a cutting box, and when fed the meal was mixed with it. Water was always given along with the food.

ESTIMATED VALUE OF THE FOOD. The food was estimated at the current market values in Guelph, viz.: pease, 55 cents per bushel; barley, 50 cents; oats, 35 cents; and wheat middlings, $15 per ton. Eight cents per 100 lb. were allowed for grinding the meal. The price of the meal mixture used was, therefore, one cent per pound. The green food was charged at $2 per ton.

FOOD EATEN. The following table gives the food consumed, (1) by each individual animal daily on an average throughout the experiment, and (2) the whole amount consumed by the pigs in each group:

——	Group 1.	Group 2.	Group 3.
	lb.	lb.	lb.
By each Animal	4½ meal.	3.09 meal. 1.85 gr. fd.	1.39 meal. 3.77 gr. fd.
By each Group	1,520 "	1,140 meal. 628 gr. fd.	514 meal. 1,392 gr. fd.

INCREASE IN WEIGHT. The next table gives the average weight of the pigs in each group, (1) at the commencement of the experiment, (2) at its close, the average individual increase in weight, and the average individual daily increase:

——	Group 1.	Group 2.	Group 3.
	lb.	lb.	lb.
Weight at commencement............	151.00	147.30	147.30
Weight at close..................	248.30	221.30	167.00
Average increase....................	97.30	74.00	19.70
Average daily increase...............	.79	.60	.16

VALUES. The third table gives (1) the average value of one animal in each group at the commencement of the experiment, (2) the cost of food for one average animal throughout the experiment (3) the average value of one animal in each group at the close of the experiment, (4) the average individual gain or loss, and (5) average individual gain or loss per cent. (a) on value of animals at commencement of the experiment, and (b) on value of animals at commencement of the experiment with market value of food included :

——	Group 1.	Group. 2.	Group 3.
	$	$	$
Value at commencement......	6.79	6.63	6.63
Cost of food	5.07	4.03	2.18
Value at close	12.17	10.84	7.10
Gain or loss	+ .31	+ .18	— 1.71
Gain or loss per cent. on animals........	+4.56	+2.71	—27.00
Gain or loss per cent. on animals and food.	+2.61	+1.69	—19.41

The pigs were valued at $4.50 per 100 lb. live weight at the commencement of the experiment, as prime animals brought $5.25 per 100 lb. at that time. At its close the pigs in groups 1 and 2 were valued at $4.90 per 100 lb., which was the market value, and those in group 3 were valued at $4.25. As to condition the animals in group 1 were fat, and those in group 2 prime, while those in group 3 were not improved in condition. It will also be observed that the market values had fallen in the meantime. The manure is supposed to form more than an offset to the cost of the labor.

After Experiment. At the close of the experiment proper on October 8 a second experiment was commenced to show the probable effects of feeding green food upon pork-making during the subsequent fattening period. During this experiment all the pigs were fed a ration similar in kind to that fed to those pigs in group No. 1 during the first experiment. This after experiment continued forty days, and at its close on November 17 the pigs were sold at $4.10 per 100 lb. live weight. The detailed results would unduly enlarge this bulletin: It may be mentioned however that although there was a slight relative increase in the rate of gain with the pigs in groups 2 and 3 as compared with those in group 1, it was not at all marked. The prices for prime pork had in the meantime fallen from $4.50 to $4.10 per 100 lb., so that the pigs during this period were fed at an actual loss.

CONCLUSIONS.

The following are the more important conclusions from the experiment :

1. That while (1) pigs fed for 123 days on a suitable meal ration and housed in summer, increase in weight at a rate of 64 per cent., (2) pigs fed on two-thirds the quantity of the same meal ration, the balance of the food being made up of green fodder cut and mixed with the meal, increase at a rate of 50 per cent., and (3) pigs fed on one-third the quantity of the same meal ration, the balance of the food being made up of green fodder cut and mixed with the meal, increase at a rate of only 13.37 per cent., the labor of feeding being also relatively greater where green fodder is given.

2. That when the prices of food and pork are the same as in this experiment, the gain from feeding pigs, as in group 1 for 123 days in summer will be but 4.56 per cent. on the first cost of the animals, as in group 2 but 2.71 per cent., and when fed as in group 3 the loss will be 27 per cent.

3. That in pork making the questions of market values and of the best season to market are of great practical importance.

4. Farmers should study to avoid marketing their pork in the months of October and November when prices are usually lower than at any other season of the year.

5. That a ration of which the major portion consists of green food, as in the case of that fed to the pigs in group 3, will fail to bring them into a marketable condition.

6. That of the rations given to the pigs in the three groups in this experiment the meal ration fed to those in group 1 has proved in every way the most satisfactory, hence

7. If feeding a bulky fodder along with meal to pigs is any aid to digestion, it must be given in a less proportion than that used in feeding the pigs in group 2 in this experiment.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LX

GROWTH AND USES OF RAPE

BY THOMAS SHAW PROFESSOR OF AGRICULTURE

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Hon. John Dryden, Toronto.

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BULLETIN LX.

GROWTH AND USES OF RAPE.

Rape (*Brassica Campestris*) was at one time extensively grown in Europe for the oil expressed from its seeds. It is now chiefly grown in Britain to provide pasture that will fatten sheep readily. In America, where there is not much of it grown as yet, it is used almost entirely for this purpose, although cattle also are pastured upon it to a limited extent.

The soils which are best adapted to the growth of rape are those of a free-working character. Any soil that is well adapted to the growth of turnips will grow rape readily. It will also grow well on peaty soils rich in humus, and fairly so on clay loams, but the results will not be satisfactory where the attempt is made to grow it on stiff clays. On the humus soils there is also difficulty in getting the seed to germinate properly in dry weather.

The proper place for rape in the rotation is between two crops of grain; and, as is the case with turnips, it may be used as a cleaning crop instead of the bare fallow. As a cleaning crop it is even ahead of turnips, especially when it follows rye grown for the silo, owing, first, to the smothering influence of the rye, and second, to the season at which the ground is plowed and cultivated.

TILLAGE. The preparation of the soil will vary somewhat with the crop preceding the rape. When the rape is not preceded by rye, autumn cultivation, with a view to weed destruction, should follow the removal of the last crop grown; and the spring cultivation, up to the time of sowing the rape, may be the same as that applied to the bare fallow. When rye precedes the rape it should be sown in August if intended for pasture in the autumn and spring following. If intended for fodder or the silo it may be sown early in September, but will sometimes do well when sowed later. In any case not less than two and a-half bushels of seed should be sown. The rye may be cut with the binder when the head begins to come out, and cured in the shock when intended for winter fodder. It should be cut at a later stage when put into the silo. The ground is plowed evenly as soon as the rye is removed. The "skimmer" should be used on the plow, so that all vegetation may be turned under. The plowing after the rye is removed will take place about the end of the first week in June. If the rye has been pastured the ground may be plowed sooner. It may then be harrowed occasionally until the sowing of the rape.

If barnyard manure can be spared for the rape, its application will be followed by a much better crop. It may be applied in the autumn or in the spring when the rape is not preceded by rye. When rye precedes the rape, there will probably not be time to apply farmyard manure after the rye is removed. The aid of artificial fertilizers may then be called in. Two hundred to three hundred pounds of salt and at least one hundred pounds of superphosphate may be sown broadcast before the last harrowing preceding the drilling of the ground for the rape. One hundred pounds of nitrate of soda, or a less quantity, may then be applied about the time of the first cultivating.

SEEDING AND CULTIVATION. The time for sowing the rape in Ontario is a little later than that chosen for sowing turnips, viz., the last week in June. The ground is put into low drills by using the double mould-board plow. These may be from 20 to 25 inches apart, and the seed is sown at once with the turnip drill, which should follow closely after the plow when the weather is dry. The field roller may then also be run over the drills as soon as sown. When rape is sown earlier than the period indicated, its later development is arrested. When it is sown later it is too succulent for very profitable feeding.

The quantity of seed sown is about one pound when sown in drills; if dry weather, more than this quantity should be sown. Three pounds may be sown when scattered broadcast, but when thus sown the cleaning of the land is not effected. The variety in common use is known as the Dwarf Essex. When rape is sown on the bare fallow, to be plowed in as a green crop, from three to five pounds of seed per acre will suffice. It is useful for this purpose.

The cultivation of rape after it has been sown is much the the same as that applied in the case of turnips, with the difference that it is not usual to thin the rape. The horse-hoe may commence to work as soon as the rough-leaf appears, and may be kept going at short intervals until the leaves meet between the rows. If the drills are gone over with the hand-hoes once or twice, all weeds may be prevented from going to seed.

FEEDING. The pasturing of the rape may commence in September. The exact time in the month will depend somewhat on the time of sowing. The pasturing may continue until the time of snow, which is usually in the last half of November.

Any class of sheep or lambs may be pastured upon the rape, but some caution should be used in pasturing breeding ewes upon it, lest they become too fat for breeding in best form. It is especially adapted to the fattening of sheep and lambs which are to be sold for meat. The latter are more frequently pastured upon it than any other form of live stock. Cattle may also be pastured upon it, but they destroy more of it through trampling than sheep. Hence, it is not nearly so much used for fattening cattle.

Sheep, or indeed any class of animals, should never be turned in upon the rape when hungry. They are then liable to eat too much, which may induce bloating, followed in a short time by death, unless relief is given. As scouring is also likely to be induced at first, the sheep should have access to an adjoining grass field and salt at will, and if they are given a small ration of oats per day, not necessarily more than half a pint, it will in some degree counteract the tendency to scour. If they are trimmed with the shears before going on the rape, the injury from scours is reduced.

When the lambs have access to an adjoining pasture, they are less inclined to lie down upon the rape. In times of severe and prolonged frosts, which sometimes happen late in November, the danger from feeding on the rape is increased, and the less mature the rape the greater is the danger. The frozen rape seems to induce various forms of digestive derangement, which sometimes end in death. The cold rain and sleet storms in early autumn are also very injurious to them; hence, sheds should be provided in which they may be sheltered and fed during the time of these cold storms. They may also be fed in these sheds after the rape is all eaten, until the time when they are sold. Where the rape has been drilled, there is also the danger that the lambs will get on their backs when they lie down and so perish; hence, it is well to have them visited and counted morning and evening by an attendant. Where the flock is very large, the attendant will find a saddle horse a valuable aid.

Experience with Rape. Our experience with rape on this farm is somewhat limited; but it has been grown by a small number of farmers in the neighborhood of Guelph for several years past. In 1889 we grew 12 acres at this station and fattened lambs upon it. In 1890, 54 acres were grown. For about two months there were pastured upon this rape 17 head of heavy steers and 537 sheep and lambs. One acre of the rape sustained 12 head of lambs for two months. At the end of this time the lambs were ready for sale, and were soon after sold for the Buffalo markets, except 120 head, which were reserved for experimental feeding with a view of shipping them to Britain in the month of May. The sheep and lambs were purchased by Mr. J. E. Story, the farm foreman, in the counties of Carleton and Lanark, in the eastern part of Ontario. The 364 head which were shipped to Buffalo on the 18th of December brought $5.62 per 100 lb. live weight. The gain on each lamb of the lot up to the time of sale, after paying all expenses of purchasing, freight, additional food and attendance, was fully $1.40 per head, that is to say, the food provided by each acre of the rape was worth to us $16.80. The return would have been better had the lambs been a uniformly good lot, which they were not, as it was late in the season before they could be purchased. They were of all shades of color in the face, from pure white to jet black. Some were well bred, but none were pure; some had no breeding. The majority were grades with more or less of improved blood. The well bred lambs gave much the best returns. A large number had long tails, and many were uncastrated. The long tails are very troublesome in case of scouring, and the neglect of castration is an egregious blunder, as this class of lambs do not feed well, are dull of sale, and can only be sold at a reduced price. Additional particulars regarding the growing of rape and feeding it off are given in the Report of 1890.

Cost of Growing Rape. The following is an estimate of the cost of growing an acre of rape based upon our own experience. The estimate is made on the supposition that the rape follows rye, which is our favorite method of growing it here:

One plowing		$2 50
Three harrowings		60
One rolling before sowing		25
Making the drills		75
Drilling in the seed		30
Rolling after sowing		25
Farm-yard manure, 15 tons	$15 00	
Drawing and spreading	4 87	
	$19 87	
One-fifth manure allowed for the rape		3 97
Cultivating four times		2 00
Hand-hoeing twice		1 00
Seed, one pound		15
Total		$11 77

In this computation the sum allowed as charge for man and team is $3 per day, and for man only $1.25 per day. The manure is valued at $1 per load in the barnyard, and it is assumed that 40 per cent. of the manure would be exhausted the first year, of which one-half would be used by the rape. It should also be noted that in damp weather it is not necessary to roll the drills after the seed has been sown. It is assumed that all the labor is hired, both of man and team. The actual cost of the farmer would be much less than the sum indicated.

The rape draws plant-food largely from the air and from the subsoil; and, as it is a gross feeder, it fills the soil with rootlets which improve the mechanical texture and tend to enrich it in their decay. It is also fed off upon the soil, which further tends to the enrichment of the same. It is therefore fair to infer that the land is considerably richer in available plant food after the rape has been fed off than it was before it was grown.

RESULTS. We have then as results the following :

(1) $16.80 as the feeding value of the rape, or a return of $5.03 per acre over the cost of tillage. This sum will vary with the season and the price of mutton.

(2) The thorough cleaning of the land, which is about as effectual as though it had been summer-fallowed.

(3) The value which will be obtained from the increase in the good crops which are grown after the rape. It will be noticed that the value of the rye grown the same season has not been included in the above statement.

GENERAL NOTES. Rape is not a suitable food for milch cows in the dairy, as when they feed upon it the milk becomes strongly tainted. But it is a good food for pigs, and they are fond of it.

It has been claimed that sheep should be folded upon the rape in order to secure a more even distribution of the manure. We have no experience on this point, but it will probably be found that the sheep will keep healthier when they have more liberty, and are allowed to lie at night upon ground which has a sward upon it.

There is much yet to be learned regarding the growth of rape in Ontario. We have to determine whether flat or drill cultivation is preferable ; whether it will repay the labor of thinning, and if so, to what extent ; and whether food adjuncts may be added while it is being pastured of such a character as to obviate all danger that may arise from digestion while feeding on the rape.

We have carried on various experiments the past two seasons which are referred to more or less briefly in the last annual Report, but no conclusions have as yet been arrived at that may be regarded as definite or final.

There is great room for the extension of the rape industry in Ontario. On the supposition that one acre of rape will fatten 10 lambs, which is a very moderate calculation, if but 100,000 acres of rape were grown yearly we could fatten annually 1,000,000 head of lambs. This acreage would be less than the hundredth part of the arable lands in Ontario.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXI

DETERMINATION OF FAT IN MILK

BY C. C. JAMES M.A., PROFESSOR OF CHEMISTRY

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
April 15 1891

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Hon. John Dryden, Toronto.

Ontario Agricultural College and Experimental Farm, Guelph, under control of the Minister of Agriculture.

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BULLETIN LXI.

DETERMINATION OF FAT IN MILK.

BABCOCK'S CENTRIFUGAL METHOD.

Methods have been suggested from time to time for the rapid determination of fat in milk, useful, not simply in the chemical laboratory, but also in the creamery, the cheese-factory and the dairy. Some of these have been modified and improved, most of them rejected as impracticable. Any method suitable to the demands of analysts and dairymen must meet at least four requirements, viz :

1. It must be rapid in its work and in giving results.
2. It must be comparatively easy of manipulation.
3. It must not be very expensive.
4. It must be accurate under varying conditions.

After a thorough test in which the results have been verified by thorough gravimetric analysis, we have concluded that the method devised by Dr. S. M. Babcock, chemist of the Wisconsin Experiment Station, most nearly fulfils the above four requirements. His method was given to the public in Wisconsin bulletin No. 24, 1890, entitled " A new method for the estimation of fat in milk, especially adapted to creameries and cheese-factories."

METHOD OF ANALYSIS. Small glass bottles are provided in which the milk is to be tested. These are seven inches high, carrying a graduated neck four inches long and one-quarter inch internal diameter. As the accuracy depends primarily upon the correct graduation of these bottles, they should be purchased only from a reliable firm that guarantee their correctness. Equal volumes (17.5 cubic centimetres) of milk and strong commercial sulphuric acid or oil of vitriol are mixed in these test bottles. The effect is that the casein is dissolved and a rim of yellowish oil begins to form on the dark purple colored solution. The test bottles are then placed in a whirling machine and while kept warm by hot water or steam the centrifugal motion forces the heavy acid to the bottom and the light oil to the top. Warm water is added and the melted oil slowly rises into the neck, the amount read by the graduations giving the percentage of butter fat in the milk. Machines may be obtained that will carry from four to sixty bottles at one time.

I shall now criticise the method under the four requirements before stated.

1. Rapidity. According to Dr. Babcock's published instructions the milk is measured into the bottles by a glass tube, the acid added measured by a small graduated glass; then they are whirled for five minutes, warm water added to each bottle, again whirled for one minute, readings taken, bottles emptied and rinsed. The amount of time required depends of course upon the number of analyses made; one whirling will do for sixty as well as for four, so that the time is principally consumed in measuring the milk and acid and in adding the warm water. After using an apparatus for some time we find that the whole operation for ten samples requires about half an hour. Taking a hint from the practice of the chemist of the Vermont Experiment Station, we have found that in our case the following method has shortened the time required and lightened the labor: 25 cubic centimetres of milk are run into the bottle, then about 3 cubic centimetres of a solution of amyl alcohol and common muriatic acid (equal parts); then the bottle is filled to the neck with strong sulphuric acid from a burette, placed in the machine without any hot water or steam, whirled for one minute, filled with warm water or acid to bring the fat into the graduated neck and the readings at once taken, seven-tenths of which gives the correct percentage of fat in the milk.

2. Ease of Manipulation. The instructions are quite simple, and present no great difficulty. The acid must be handled carefully, as it rapidly chars wood and burns clothes and fingers. The sampling must be done carefully and conscientiously. A little natural knack or dexterity in work will greatly assist in the carrying on of the testing, but I can see no reason why a person of ordinary intelligence by carefully following the instructions should not have success in every determination.

3. Cost or Expense. The first cost is the principal cost, apart from the time of the person who makes the determinations. If care is exercised no bottles need be broken. Beyond that, the acid is the only material or agent absolutely demanded. This costs from one cent to one-quarter cent per test, according to the quantity of acid procured. If the solution of amyl alcohol and muriatic acid is used, the cost will be slightly increased (about six to ten cents for

every hundred tests). The first cost of the complete outfit may be gathered from the following three sets of catalogue prices :

Machines made by Cornish, Curtis & Greene, of Fort Atkinson, Wis., for which John S. Pearce & Co., of London, are Ontario agents.

4 bottle test machine	$14 00
10 " " "	20 00
15 " " "	22 00
20 " " "	25 00
30 " " "	29 00

The Beimling machine used by the Vermont Experiment Station, handled by the Creamery Package Manufacturing Co., 20 N. Clark St., Chicago, Ill.

3 bottle test machine	$20 00
6 " " "	25 00
12 " " "	32 00
24 " " "	50 00

Machines made by D. H. Roe & Co., 54 North Clinton St., Chicago, Ill.

4 bottle test machine	$8 00
8 " " "	10 00
12 " " "	14 00
24 " " "	20 00
30 " " "	40 00
60 " " "	50 00

I understand that some other United States dealers are handling machines, but we have not seen their prices. Our Canadian dairy supply companies should be in a position either to manufacture or to handle for this province some of these machines.

4. Accuracy of Results. The first experiment made by us was to test the agreement of the bottles with one another. They read as follows on a sample of milk :

Seven bottles gave	2.7 per cent. fat.
Three bottles gave	2.8 " " "

A gravimetric analysis made in duplicate by the asbestos method gave us for the same milk 2.65 and 2.68 per cent. fat. We have since tested the bottles and also those of the Beimling machine, as follows :

All bottles	C., C. & G. machine	3.36 per cent. fat.
	Beimling machine	3.31 " " "

An advantage of this method is that sour milk can be handled quite easily. We tested a sample of milk fresh and then again after two days standing.

Fresh milk by machine gave	3.6 per cent. fat.
Same milk very sour gave	3.6 " " "

For the analysis of skim milk and buttermilk, bottles can be obtained that give more delicate readings. We made four comparisons on different days with different milks between this rapid method and the gravimetric method (in duplicate) as follows :

(*a*)	Rapid centrifugal	2.7	per cent. fat.
	Gravimetric (asbetos method)	2.67	" " "
(*b*)	Rapid centrifugal	3.6	" " "
	Gravimetric (asbestos method)	3.65	" " "
(*c*)	Rapid centrifugal	4.3	" " "
	Gravimetric (asbestos method)	4.2	" " "
(*d*)	Rapid centrifugal	3.85	" " "
	Gravimetric (Adam's paper method)	3.74	" " "

If the bottles are accurately graduated and the instructions are followed, I consider the method exceedingly satisfactory. It is especially useful in experimental work, in chemical laboratories, milk inspection in cities, and in connection with dairies, creameries and cheese factories. It has enabled us to accomplish a larger amount of analytical work than ever before, and is in daily use in our laboratory. Any one desirous of seeing the machines, their method of work, and of judging for themselves as to whether their use is practicable in their work, will be welcome at the chemical and dairy department of this institution. Their use by city health officers and food inspectors, by enterprising breeders of dairy cattle, and in experimental work where every pail of milk is to be analysed is to be strongly commended. With large creameries and cheese factories, the whole question turns on the amount of time required for the work, or the number of analyses to be made each week.

In conclusion I append, as showing the use to which the machine can be put, the average of one week's analyses of milk from six ordinary cows fed for experimental purposes.

Cow.	Average for one week of	
	Morning milk.	Evening milk.
No. 1	3.25	3.96
No. 2	2.76	4.00
No. 3	3.18	4.33
No. 4	3.42	4.45
No. 5	2.75	4.18
No. 6	2.63	3.70

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXII

BARK-LOUSE AND PEAR-TREE SLUG

BY J HOYES PANTON PROFESSOR OF NATURAL HISTORY AND GEOLOGY

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
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HON. JOHN DRYDEN, TORONTO.

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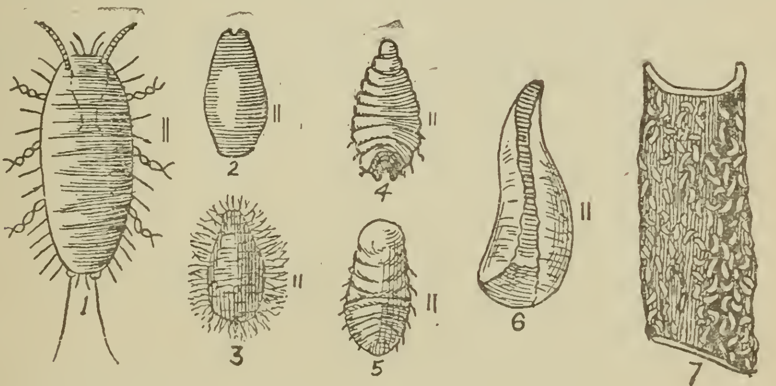
BULLETIN LXII.

OYSTER-SHELL BARK-LOUSE AND THE PEAR-TREE SLUG.

Several inquiries have come to the College in reference to the nature of the above insects and the best means to use in order to get rid of them.

This bulletin has been prepared with the object that it may prove of practical importance not only to those who have asked information upon the subject, but also to many others in the province whose orchards are infested by these pests.

OYSTER-SHELL BARK-LOUSE (*Mytilaspis pomorum*). This minute insect, found upon the bark of the small twigs of the apple tree, is readily identified by its oyster-shell shaped scale, about one-sixth of an inch in length. This scale is of a brown color, and thus disguised by the bark is not seen unless by close observation.



Oyster-shell Bark-louse. *1. Insect. 2. Egg. 3. Forming scale. 4 and 5. Further development. 6. Scale. 7. Scales on bark of twig.* || on right of first six cuts denotes natural size.

Usually a good many are clustered together, and their shape is so marked that we soon recognise them. Though largely found upon the twigs, they are also found upon branches and limbs of considerable size. If the scales be raised up and examined beneath, any time in the fall or winter, numbers of very small white particles will be observed, which on close examination will prove to be eggs. Here beneath the peculiarly oyster-shell shaped scales they remain until early in the summer. As soon as the weather is favorable, especially about the end of May or the beginning of June, the tiny eggs hatch, and out from beneath the scale issue the bark-lice, which are exceedingly small. They scatter themselves over the twigs of the tree, seeking suitable spots for further development. Having found such, the minute insects fix themselves upon the tender growing bark. This they pierce with the beak-like structures connected with their mouths, and by means of which they are able to suck the sap from the twig or branch upon which they are located. Once fastened to the twig, they remain attached and do not move about; consequently this continual drain upon the tree's sap, especially when they are numerous, soon affects its vitality. It is not an uncommon thing to see a branch almost completely covered with the scales. Permanently fixed, they continue feeding from the sap of the tree until toward the end of August or September; by this time they have reached full size and gradually form the scale by means of waxlike threads that issue from their bodies, and which eventually make the scale. Under these the female deposits her eggs, and by the time her work is completed she has shrivelled up to a mere speck and her existence is at an end. At this stage an examination of the scale beneath would show a mass of tiny eggs, with little or no trace of the insect that laid them. The scales we see are almost invariably those formed by the females; those of the male being seldom seen, and then most frequently upon the leaves. They are much smaller in size and somewhat different in shape. The peculiar nature of bark-lice prevents to a great extent their spreading from tree to tree, and in many cases no doubt they have been upon the trees when first planted, but have not been observed till, it may be, years afterwards, when they have multiplied so as to cover the branches and be readily seen. They may be carried to some extent from tree to tree by birds, and also by other insects at a time when they are in search of proper places for location. Such is the life-history of this bark-louse, which seems to be rapidly spreading over the country.

Remedies. We shall now suggest some remedies for its destruction:

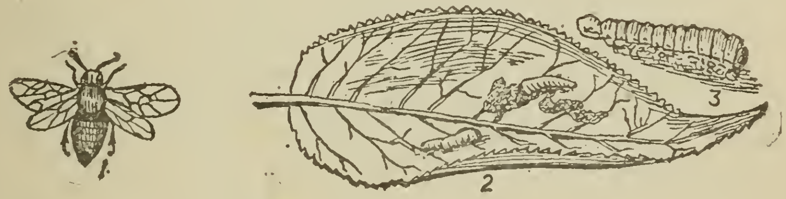
1. Examine infested trees carefully during May and the beginning of June, and as soon as the tiny lice are seen crawling about spray the tree with the following kerosene emulsion: one-half pound of hard soap in one gallon of boiling water; to this add two gallons coal oil and thoroughly mix. This on cooling, if well mixed, will form a jelly-like substance. When about to use, add nine parts cold water and spray upon the trees. Thorough mixing can be effected by forcing the mixture through a force pump with a small nozzle until the whole forms a creamy mass.

2. In the winter and spring scrape off the trunk and larger branches as many of the scales as possible, and then thoroughly scrub with a scrubbing-brush or broom dipped in the following solution: one quart

of soft soap, or one-quarter pound hard soap, in two quarts of boiling water. To seven parts of this add one part of crude carbolic acid.

3. Soft soap made about as thick as paint by adding a strong solution of washing soda in water. This applied to the trunk and limbs improves the vigor of the tree as well as gets rid of the bark lice.

PEAR-TREE SLUG (*Selandria cerasi*). The eggs of this insect are usually deposited early in June in the leaf, which appears marked with semicircular incisions. These have been made by a peculiar structure which the female has for the purpose. The eggs soon hatch and the young slug develops until it reaches about one-half an inch in length. It presents an unattractive appearance, being somewhat blackish or bottle green in color, covered with an olive-colored slime. The front part of the body is swollen, and the slug resembles a tadpole in appearance. It has a disagreeable odor. During the slug period of its existence it feeds upon the foliage of the pear, cherry and plum, and in some places becomes a serious trouble. The larval condition being completed, it leaves the tree and spends a portion of its existence in the ground, from which in due time it emerges the perfect insect—a fly of a glossy black color with four transparent wings and dull yellow legs. The female is about one-fourth of an inch long and the male somewhat smaller. The first appearance of the slug is near the end of May until the middle of June, but another brood may appear near the end of July or August. The cherry and pear trees should be examined for these troublesome insects about the middle of June, and again early in August. They are very voracious, and can soon destroy the foliage of a tree. When attacked, the leaves wither and look as if scorched by fire.



Pear-tree slug. *1. Insect. 2. Slugs feeding on leaf. 3. Slug, enlarged size.*

Remedies. The following remedies are suggested :

1. Syringe with hellebore mixed with water in the proportion of an ounce to two gallons.

2. Syringe with Paris green, one teaspoonful to two gallons water.

3. Dust upon the foliage fresh air-slaked lime.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXIII

PITTING THE SUGAR BEET

BY C. C. JAMES, M.A., PROFESSOR OF CHEMISTRY

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BULLETIN LXIII

EFFECTS OF PITTING ON SUGAR BEETS FOR SUGAR MANUFACTURE AND FOR FEEDING.

The report upon our investigations in regard to the growing of sugar beets for sugar production has been given in the lately published report of the Ontario Agricultural College and Experimental Farm for 1890, pp. 66 to 75 and 96 to 98, to which the attention of the reader is directed in connection with this bulletin.

Preservation of Beets. The preservation of the sugar beet between the time of its removal from the ground until it can be worked over in the factory will be a matter of very great importance in this province where the winters are severe and sometimes quite changeable. When the growth of the beet has stopped and the products of the leaves have been transferred to the root, the beet is said to be "ripe," and is ready to be harvested. The signs of this condition in the leaves are the color and the drooping of the leaves; the color changes to a yellowish green and the outer leaves droop or wither and fall as though showing that their season is done. If the beets are to be taken straight to the factory the green heads or collars as well as the leaves may be cut off and left upon the field, but if they must be preserved for some time it is customary not to cut them down too much. "Generally the beets that have been cut close show no tendency whatever to sprout, that is to show leaves in the silo. But their sprouting is a sign of the cessation of all vegetable life, and is generally accompanied by an undesirable change known as 'hardening' in the juice, which is more injurious in the manufacture than the development of sprouts, and which latter, if it has not progressed too far, is preferred by the manufacturer." (*Report by L. S. Ware, 1889.*)

In the preservation of the beets, whether in cellar or in pit, four conditions are to be avoided, viz., excessive cold, as freezing and thawing inverts the sugar and causes loss in the factory; excessive heat, as the resulting growth uses up sugar rapidly; excessive moisture inducing decay; and excessive dryness causing a withering. The conditions, therefore, are moderate and the aim is to preserve the beet in about the same condition in which it is as it comes from the ground before frost.

EARTH PITS. The earth pit or silo is most extensively used in Europe where the preservation in winter is as great a difficulty as with us in Ontario. These pits may be temporary and simple in construction or they may be permanent, well paved and walled. They are about six feet deep, ten feet wide, and as long as the extent of the crop demands. A small ditch down the centre of the pit permits the excess of water to escape and a free circulation of air is allowed by having an open floor of holes and a ventilating shaft through the centre. The beets, culled and sorted, are then carefully piled in, a sloping roof-shaped heap formed by them above ground, and then they are covered with earth. The depth of earth required in this province and the advisability of using straw between the beets and the earth will be matters of experiment for the future. The depth will, no doubt, be largely controlled by the severity of the weather.

OUR EXPERIMENT. The sugar beets grown at this farm in 1890 were placed in a pit or silo by Prof. Shaw, and the pit was opened on March 12th, 1891 (about the end of the sugar making season), for the purpose of examining the beets and of obtaining samples for analysis. Shortly afterwards the beets were fed to the stock. In general appearance the beets seemed about as when first pitted, except that sprouting had taken place in some. The loss in sugar amounting to a little over two per cent. would seem to indicate that they would have turned out a little better, for the producer at least, if they had been topped a little closer. The loss of sugar in the silo should not much exceed one per cent. At the same time the beets analysed weighed over one pound, a fraction more than the average taken last fall, whereas to get results fairly comparable, they should have weighed a little under one pound. The beets taken out were analysed in three lots. I give the results and also the average of 53 beets analysed by Mr. W. Skaife and myself of the freshly harvested beets, omitting however the larger beets from the outside row.

Allowing for any errors in sampling we can safely conclude that the beets lost about two per cent. of sugar in the silo, that the co-efficient of purity, however, remains about as before, and that the beets even after being preserved five months in a simple earth silo came out in a condition very favorable to the production of sugar. There seems to be no doubt that in this province the sugar beet can be preserved as long as necessary through our winter months in a condition suitable for sugar making.

ANALYSIS OF PITTED SUGAR BEETS.

No. of beets taken.	Weight lb.	oz.	Analysis of juice. Solids.	Sugar.	Purity.	Remarks.
4	4	0	15.00	12.58	83.86	Slightly sprouted.
4	5	0	16.00	13.02	81.38	Grown above ground.
4	4	10	14.76	12.01	81.37	Well grown, fair.
Average after pitting......	1	2	15.26	12.54	82.20	
Average before pitting......	1	1	18.02	14.77	81.97	

SUGAR BEETS AS FODDER. In many parts of Ontario sugar beets have for years past been grown for stock feeding, and the acreage will this year probably far exceed that of former years, as in some districts extensive experiments are being carried out to determine the practicability of beet sugar production. The farmer in these circumstances always has the second string to his bow, if he cannot find a factory for his beets he can feed them to his stock. With the view of determining their value in stock feeding in comparison with other roots we have analysed sugar beets from the pit and turnips and mangels from the farm root cellars, all of them taken about the end of March. The value of roots in a ration consists principally in their high percentage of carbohydrates (starch and sugar). By their water they offset the dryness of hay, straw and grain. They are usually quite palatable and appetising and have a toning up effect upon animals that is not brought out in a chemical analysis or statement. I give the next analyses of these three roots, stating first their composition, dry or water free, and below that as fed:

—	Water.	Crude protein.	Crude fat.	Carbo hydrates.	Crude fibre.	Ash.
1. Dry.						
Sugar beets..........	....	9.03	0.67	80.39	6.09	3.82
Turnips	....	11.89	1.35	73.73	8.57	4.46
Mangels	....	17.69	0.91	67.98	6.44	6.98
2. As fed.						
Sugar beets	82.93	1.54	0.11	13.73	1.04	0.65
Turnips	87.09	1.54	0.17	9.53	1.10	0.58
Mangels	91.00	1.59	0.08	6.12	0.58	0.63

The sugar beets contain far less water than the other roots and far more carbohydrates, and as the feeding value consists principally of sugar and starch, it will at once be seen how much more valuable pound for pound the sugar beets are than mangels or turnips. If we compare them on the basis of their value as heat and force producers (which is their principal use in a ration) the beets, turnips and mangels will have about the values of 4, 3 and 2 respectively. The great value of sugar beet for fodder, apart from their value as a source of sugar ought to be carefully considered by the farmers of this province. The use of sugar beets in feeding for milk production in preference to turnips need not be dwelt upon here. Another point to be observed is that the sugar beets most valuable for sugar making are also most valuable for feeding; the high percentage of sugar so profitable for the sugar factory is as much to be desired for feeding, and the use of "thoroughbred" seed and the practice of the best methods ought to be strongly emphasised. The same care used in the production of beets for the factory will pay in the raising of beets for fodder. Suppose we take an example—an acre of sugar beets is grown containing say 15 tons; one sample of medium sized beets last year gave us 11.5 per cent. sugar, while another sample, the best, of about the same size had 17.5 per cent. sugar. The former would contain about 3,280 lb. of sugar per acre, the latter would contain about 4,990 lb., an increase in value of over 50 per cent. above the former, whether for sugar making or for feeding, and as this sugar comes entirely from constituents found in the air and is not produced at the expense of the soil it follows that the growing of the best sugar beets, the richest in sugar and the purest in quality, is to be recommended.

1. Use only reliable seed, highly developed, sugar producing in its strain, imported fresh from the best French or German sources.
2. Grow beets of moderate size rather than too large, the moderate sized beets have more sugar and less water than the larger beets.
3. Keep them well covered all the season through as sugar is found principally in the portion below ground.

CULTIVATION. The closing paragraph in a late publication from the great French sugar beet firm, Vilmorin Andrieux & Co., is so important in regard to the production of sugar beets for sugar purposes and for fodder, and is so authoritative that I take the opportunity of closing this bulletin with a translation of the same: "We cannot insist too much upon the necessity of choosing well and of preparing properly the land intended for the cultivation of sugar beets. It happens almost daily that the seeds and those who have furnished them are held responsible for failures and mistakes arising solely from the bad conditions under which the growth has taken place. Every one desires, and rightfully so, to obtain only beets that are long, clean, compact (without branching roots), but it must be considered that to be developed in this condition the beets must necessarily find a depth of earth sufficiently mellow to be produced there without hindrance; nothing promotes so surely the development of lateral roots as the prevention of the lengthening of the tap root owing to the hardness or poor quality of the sub-soil. It is the height of inconsistency to expect roots to be long, clean and under ground, and to refuse them the room absolutely necessary for their development. The food or manure ought to be carefully suited to the local circumstances; the multiplication of fields of experiment has contributed for some years past in furnishing more and more fully all the instructions necessary for this subject. The adoption of the best methods of growth is of great importance after the choice of the best varieties, for the *maximum* of produce, both in weight and in quality, can be obtained only from the best seeds well cultivated."

On page 5 of the bulletin issued April 15th, 1891, on "Determination of Fat in Milk," prices were given of machines handled by Cornish, Curtis & Greene, ; the Creamery Package Co. ; and D. H. Roe & Co. It should have been stated that the prices for the Cornish, Curtis & Greene machine are those from the circular of John S. Pearce & Co., London, and are Canadian prices ; the others are United States prices. Whether to get the Canadian prices for the other machines it would be necessary to add 30 per cent. for duty or not I cannot definitely say, as these machines may perhaps be sold to Canadians at lower rates than those published to meet the duty in part. As it has been considered advisable by those interested to call attention to this difference, I add this note to the present bulletin.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXIV

ENSILAGE AND ROOTS FOR SWINE

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
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HON. JOHN DRYDEN, TORONTO.

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BULLETIN LXIV

ENSILAGE AND ROOTS AS FOOD FACTORS IN SWINE FEEDING

This experiment began on December 4th, 1890 and closed on March 4th, 1891, covering a period of 90 days. The after experiment growing out of it lasted 47 days. Its primary object was the same as that of the experiment the results of which are given in Bulletin LIV, issued October 1st, 1890, viz. to ascertain the value both essentially and relatively of corn ensilage and roots, when used as food adjuncts in feeding swine in the winter season. A second object was to ascertain the cost of making pork at the current market values of the food and pork respectively. A third object was to demonstrate the extent of the loss from feeding swine after they have become fit for slaughter. Several other facts of much interest were brought out in the experiment, as the profits arising from the judicious feeding of swine, the losses arising from feeding them injudiciously, and the influence of corn ensilage and roots respectively on development during the subsequent fattening period.

THE ANIMALS SELECTED. The animals chosen for the experiment were all sired by the same pure-bred Berkshire boar and bred upon the farm. They were divided into three groups, each consisting of three animals, one barrow and two sows. Eight of the nine were the offspring of a high grade Berkshire sow, and were 209 days old at the commencement of the experiment. The ninth was also from a sow of similar breeding, and was farrowed about the same time as the litter already mentioned. They were all in good store condition at the commencement of the experiment. The conditions therefore were very similar.

PERIOD OF PREPARATION. Two weeks prior to the commencement of the experiment the pigs in the different groups were put in separate pens, 6 ft. by 10 ft., which was all the room available. They were then fed on the respective rations given to them during the experiment, the object of which was to accustom them to the new diet. Before they were selected for the experiment they had been fed on a meal ration more or less varied and refuse from the College.

FOOD AND FEEDING. The pigs in group 1 were fed all the meal they would eat up clean. They took 14 lb. per day until within ten days of the close of the experiment, when they would take no more than 10 lb. per day. Those in group 2 were fed about one-half as much meal as the pigs in group 1, and in addition all the turnips they would eat without waste. They were given 40 lb. per day until within 28 days of the close of the experiment, when they took 45 lb. per day. The pigs in group 3 were also given about one-half as much meal as those in group 1, and in addition all the corn ensilage virtually that they could utilise. They took 20 lb. of the ensilage per day until within 15 days of the close of the experiment, when the quantity was increased to 25 lb. per day. The aim was to make the quantities of meal given to the pigs in groups 2 and 3 respectively exactly one-half the amount given to the pigs in group 1, but a slight variation was caused by the reduction already noted in the quantity of meal given to the pigs in group 1. The meal ration given was the same in kind throughout and in each instance, and was also similar in kind to that used in the corresponding experiment of the previous year. It consisted of ground oats, ground barley, ground pease and wheat middlings, in the proportions by weight of 1, 1, 2 and 1 respectively. The food was given in three feeds per day. In feeding, water was first poured into the trough in each instance. To the pigs in group 1 the meal was then given; to those in group 2 the turnips, followed by the meal; and to those in group 3 the ensilage, followed by the meal. The ensilage was cut into lengths of about 1½ inches. The quality was not the best, as the corn had scarcely become sufficiently matured when it had to be cut. The pigs only ate the more succulent portions of the ensilage, the other portions were simply chewed. The pigs in group 1 required water additional to that given them along with the food.

ESTIMATED VALUE OF THE FOOD. The various components of the meal ration were estimated at current market values in Guelph, viz.: oats, 38 cents; barley, for feeding purposes, 45 cents; pease, 58 cents per bushel; and wheat middlings, $15 per ton. Eight cents per 100 lb. was allowed for grinding the meal. The price of the meal mixture used was, therefore, practically one cent per pound, which was one-eighth of a cent more per pound than in the experiment of the previous year. The roots were charged at eight cents per bushel, as in the experiment of the previous year; but the corn ensilage, which in that experiment was given a value of $2.50 per ton, was in this one put at $2 per ton, as in our experience in growing corn since that time we have found that it can be grown for a less sum than the price then fixed upon.

FOOD EATEN. Table I gives the food consumed (1) by each individual animal daily on an average throughout the experiment, and (2) the whole amount consumed by the pigs in each group:

—	Group 1.	Group 2.	Group 3.
	lb.	lb.	lb.
By each animal....	4.53 meal.	2.30 meal. 13.73 turnips.	2.30 meal. 6.93 ensilage.
By each group....	1,224 meal.	621 meal. 3,708 turnips.	621 meal. 1,872 ensilage.

WEIGHTS. Table II gives (1) the total weight of each group (*a*) at the commencement of the experiment, and (*b*) at the close, (2) the increase in weight of each group, (3) the average daily increase of each group, (4) the average individual increase of each group, and (5) the average individual daily increase of each group :

—	Group 1.	Group 2.	Group 3.
	lb.	lb.	lb.
Weight at commencement...........	465.0	442.5	472.0
Weight at close......................	728.0	606.0	543.0
Increase per group....	263.0	163.5	71.0
Average daily increase per group....	2.922	1.817	.789
Average individual increase... .. .	87.667	54.500	23.667
Average individual daily increase	.974	.606	.263

VALUES. Table III gives (1) the value of the animals in each group at the commencement of the experiment, (2) the market value of the food consumed, (3) the total value of the animals and food, (4) the value of the animals at the close of the experiment, (5) the increase or decrease in value of the animals at the close of the experiment, as compared with their value at the commencement, with the value of the food fed added, and (6) the average gain or loss per cent. on the investment :

—	Group 1.	Group 2.	Group 3.
	$ c.	$ c.	$ c.
Value at commencement...........	17 44	16 59	17 70
Cost of food.......................	12 24	11 15	8 08
Total cost of animals and food...	29 68	27 74	25 78
Value at close	32 76	25 15	21 72
Gain or loss (—)	3 08	—2 59	—4 06
Gain or loss per cent. on investment..	10 38	—9 34	—15 75

The pigs were all valued at $3.75 per hundred pounds live weight at the commencement of the experiment, as this was the price given in Guelph market at the time. At its close the pigs in group 1 were valued at $4.50 per hundred, the market price in the same place at that time. Those in group 2, which were not in prime condition, were valued at $4.15 per hundred, and as those in group 3 were not much improved in condition they were valued at $4 per hundred. The price of pork had advanced in the interval ; hence they were rated a little higher than at the commencement of the experiment.

THE AFTER EXPERIMENT. An after experiment was then commenced March 4 and continued until April 20th, a period of 47 days. Its objects were threefold, viz : to ascertain (1) the results from feeding pigs on a meal ration after they are ready for market ; (2) how those results compare with the results obtained from fattening pigs for a similar period and on a similar ration, which had been fed as those in groups 2 and 3 of the experiment ; and (3) the comparative gain or loss from fattening pigs on meal alone, as compared with feeding them on a ration of meal and turnips in one instance and meal and ensilage in another, and then finishing them on a ration of meal. The respective groups were the same as in the experiment. They were all fed on meal similar to that used in the experiment. They were given practically all they would eat ; but while those in groups 2 and 3 took about the same quantity they each consumed much more than those in group 1.

FOOD EATEN. Table IV gives the amount of food consumed during the after experiment, arranged as in table No. 1.

——	Group 1.	Group 2.	Group 3.
	lb. meal.	lb. meal.	lb. meal.
By each animal daily	3.07	6.14	6.14
By each group in period	433.	866.	866.

WEIGHTS. Table V gives the weights during the after experiment, arranged as in table II :

——	Group 1.	Group 2.	Group 3.
	lb.	lb.	lb.
Weight at commencement...........	728.	606.	543.
Weight at close.	757.	737.	763.
Increase per group..................	29.	131.	220.
Average daily increase per group....	0.617	2.787	4.681
Average individual increase.........	9.667	43.667	73.333
Average individual daily increase....	0.206	.929	1.560

VALUES. Tabie VI gives the values during the after experiment, arranged as in Table III :

——	Group 1.	Group 2.	Group 3.
	$ c.	$ c.	$ c.
Value at commencement	32 76	25 15	21 72
Cost of food.........	4 33	8 66	8 66
Total cost of animals and food...	37 09	33 81	30 38
Value at close	34 06	33 16	34 33
Gain or loss	—3 03	—0 65	3 95
Gain or loss per cent. on investment .	—8 17	—1 92	13 00

At the close of the after experiment all the animals in the different groups were sold for slaughter at $4.50 per hundred live weight. The condition of the animals in groups 2 and 3 when sold was prime, in fact very similar to the condition of the pigs in group 1 at the close of the experiment proper. The weights on each occasion were taken after a fast of fifteen hours.

FINANCIAL SUMMARY. The financial results of the whole test which lasted for 137 days are given below :

——	Group 1.	Group 2.	Group 3.
	$ c.	$ c.	$ c.
Value of animals on Dec. 4th, 1890...	17 44	16 59	17 70
Cost of food during experiment.....	12 24	11 15	8 08
Cost of food in after experiment	4 33	8 66	8 66
Total cost of animals and food...	34 01	36 40	34 44
Price realised when sold, April 20,1891	34 06	33 16	34 33
Gain or loss	0 05	—3 24	—0 11

It will be observed that at the close of the experiment proper on March 4th, 1891, the gain or loss on the experiment was as follows : With group 1 the gain was $3.08, with group 2 the loss was $2.59 and with group 3 the loss was $4.06.

It should be borne in mind that there was a profit on the food fed, as it was charged at market values instead of the cost of production. What this profit would be it would be scarcely possible to estimate correctly.

CONCLUSIONS. The following are the more important of the conclusions from the experiment:

1. That in fattening store pigs of the age indicated for 90 days on a meal ration, such as that used in the experiment, the handsome profit of 10.38 per cent. was realised on the investment, the food being charged at market values. Where the food is raised on the farm there would be an additional profit in most instances.

2. That it has not been found profitable to feed store pigs of the age indicated for a lengthened period on a ration, one-half of which is composed of meal similar to that given to the pigs in group 1, the balance being made up of turnips, as in this experiment the loss from feeding such a ration for 90 days was 9.34 per cent. on the investment.

3. That it has not been found profitable to feed store pigs of the ages indicated for a lengthened period on a ration, one-half of which is composed of meal similar to that given to the pigs in group 1, the balance being made up of corn ensilage, as in this experiment the loss from feeding such a ration for 90 days was 15.75 per cent. on the investment.

4. That in fattening pigs of the age indicated for 90 days, it required the daily consumption of 4.53 lb. of meal to produce an average gain of .974 lb. per day.

5. That after pigs have reached that stage in the fattening process when they cease to make a relatively good increase in weight for the food fed, they are then kept at a loss. The extent of this loss in the present instance was very material. With the pigs in group 1 it was no less than 8.17 per cent. on the investment in 47 days. Every 100 lb. of additional weight of pork was made at a cost of $14.93, while in the experiment proper with the same animals it cost only $4.65.

6. That in feeding pigs of the ages indicated for a period of 90 days on a ration, one-half of which was meal and the balance turnips in the one case, and corn ensilage in the other, and then subjecting them to a fattening process on a meal ration for 47 days, the influence of the corn ensilage on development during the said period was much more marked than that of the turnips, as in the former instance the average daily gain during the fattening period was 1.560 lb. and in the latter but .929 lb. although the amount of food consumed in each instance was the same.

7. That in this experiment it was found that there was no material profit from the pigs of the groups which were fed for the longer term, which would seem to indicate that pigs should be finished for market at an early age to get the best results.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXV

GINSENG

BY J. H. PANTON, M.A., PROFESSOR OF NATURAL HISTORY AND GEOLOGY.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
June 15, 1891

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Hon. John Dryden, Toronto.

Ontario Agricultural College and Experimental Farm, Guelph, under control of the Minister of Agriculture.

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BULLETIN LXV

GINSENG (ARALIA QUINQUEFOLIA).

An Act of Parliament, having been passed at the last meeting of the Ontario Legislature, for the protection of the plant ginseng, the Minister of Agriculture has thought it advisable to have the following bulletin published, containing a description of the plant, so that the people of Ontario may be better acquainted with a plant of so much economic value and to a certain extent comparatively common throughout our province, though unknown to many.

The following are the clauses of the bill, from which it will be seen that the plant cannot be picked before September 1st, so as to enable it to ripen its fruit :

1. Except for the purpose of clearing or bringing land into cultivation, no person shall, between the first day of January and the first day of September in any year, cut, root up, gather or destroy the plant known by the name of ginseng whenever such plant may be found growing in a wild or uncultivated state.

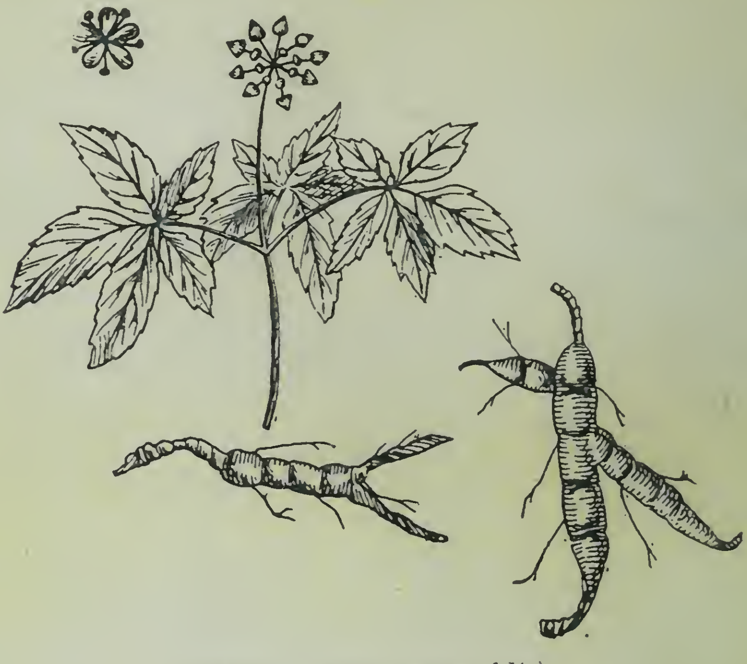
2. Any person who contravenes the provision of this Act shall, for every such offence, upon summary conviction before any justice of the peace, be subject to a penalty of not less than $5 or more than $20, together with costs for prosecution, and one-half of such penalty shall be paid to the prosecutor, unless otherwise ordered by the said justice convicting.

BOTANICAL DESCRIPTION. Ginseng (*Aralia quinquefolia* formerly *Panax quinquefolium*) belongs to the order Araliaceae, a family of plants closely allied to the order in which we find such plants as the carrot, parsnip, and celery. Root large and spindle-shaped, often forked, four to nine inches long, aromatic ; stem one foot high, herbaceous, bearing a whorl of three palmately, 5-7 foliage leaves ; the leaflets long stalked, mostly five in number, large and thin, obovate-oblong, pointed and serrate ; a simple umbel of flowers upon a *single*, slender, flower stalk ; flowers from June to August with small yellowish flowers, followed by fruit as bright red berries.

POPULAR DESCRIPTION. Main stem about one foot long, branches into three stalks at the summit, each three and one-half inches long ; on the end of each of these are arranged five leaflets borne on slender stalks an inch in length. The leaflets are thin, smooth below and of delicate structure ; two in each cluster are about two inches long and the others almost four, oval in general form, but tapering to a point and doubly toothed along the edge. Rising from the main stem and in the centre of the three compound leaves is a stalk three inches long bearing inconspicuous greenish white flowers, appearing not unlike a small head of white clover.

This *single flower stalk* is an important point, for I have found some calling a plant of this family ginseng (Aralia quinquefolia) which had four flower stalks and belonged to an entirely different species, though of the same genus.

The root of a specimen in the College herbarium is quite fleshy, rather short (three inches) and from it arises the single stem already described. By means of the above descriptions, technical and popular, together with the accompanying cut the reader will readily identify the plant ginseng from other plants in the vicinity.



GINSENG (*Aralia quinquefolia*).

HISTORY OF GINSENG. The genus Panax was first applied to it, and not Aralia ; this was, no doubt, on account of its being considered by the Chinese as a panacea for all diseases. The name of the plant, among both the Chinese and the North American Indians, means, in their language, the figure of a man, and was given to it from a fancied resemblance of the human figure. In fact, much of its virtue seems to depend upon its form. With us there is little faith in its medicinal power, but the Chinese have unbounded belief in it and hence are eager to secure it. The emperor of the Chinese at first monopolised the right of collecting the roots, and whole districts were carefully guarded against any one gathering it, except the 10,000 he employed for the purpose. Each of these collectors in the year 1709 was bound to furnish two ounces free, and then was at liberty to sell the rest to the emperor for its weight in silver. If the root had the form of a human being it could be sold for its weight in gold. Even to-day great prices are paid for large and curiously shaped specimens, especially if they resemble the human figure. It was first discovered in Canada, near Montreal in 1716, by Father Lafitau, a Jesuit missionary among the Iroquois, and in 1718 a description of it was furnished. The French soon engaged in collecting and exporting it to China, and so great did the trade become that it gave quite an impulse to the commerce of Montreal for a number of years. At one time great numbers of Indians were engaged in gathering it about Montreal and Quebec and large quantities of it were sent to China. In 1832 the shipments of ginseng from the United States amounted to 407,067 pounds, valued at $99,303. In one county in Wisconsin the trade is reported to have reached, in 1858 $40,000 and in 1859 $80,000. Immense quantities have been exported from Minnesota. At present the chief sources of the plant in the States are Ohio, West Virginia and Minnesota. About the close of the eighteenth century it was discovered also in Massachusetts, its exportation commenced and large returns obtained. During the last year 75,000 pounds were sent from America. In the forests of Tartary, where it was once plentiful, it is now almost extinct and hence has arisen the demand for it from America. It is not regarded of any value in this country as a medicine. Some are fond of chewing it as the taste is rather agreeable, being sweet, bitter, somewhat aromatic and pungent. The fact that Chinese doctors claim, that the roots of different shape possess widely different medicinal properties indicates, that its healing virtues are more of an imaginary character than real. But faith in its virtues continues, and as yet a great demand for it exists. The Chinese physicians introduce it into almost all their prescriptions for the nobility, to heal the sick and increase the vigor of the healthy.

A traveller in China remarks, he never entered a drug shop but ginseng was being sold. Volumes have been written by Chinese doctors upon its medicinal powers, asserting that it gives ready relief in extreme fatigue, renders respiration easy, strengthens the stomach, promotes the appetite, relieves all nervous affections and gives a vigorous tone of body, even in extreme old age.

The following figures taken from the *Canadian Pharmaceutical Journal*, April, 1891, will give some idea of the trade in ginseng in Canada :

The quantity sent out of Canada last year is stated to represent

$100,000, and one retail druggist exported $1,600 worth. From along the Kingston & Pembroke Railroad fully $20,000 worth was shipped. The price realised was from $3 to $3.50 per pound for dry roots. The question is now being considered whether it would not pay to cultivate it. Such is done in some parts of the United States, and in order that readers of this bulletin may understand how to do it, the writer inserts a description of the process taken from the December issue of the *American Agriculturist* :

CULTIVATION. "It appears to thrive best in loamy soils, such as are usually found in sugar maple and oak forests at the North. Shade seems also to be essential, for when the plants are exposed to the direct rays of the sun they soon die out, and for this reason open field or garden cultivation of the plants has rarely or never been attended with success. The proper way to start a plantation is to select a piece of land at the edge of some forest where the plants are found growing wild. Then clear out all the underbrush and small trees, leaving just enough of the larger ones to afford the shade required. This should be done in spring or during the summer, then break up the surface of the soil with a harrow, steel rakes, hoes, or other implements to the depth of two or three inches, removing all weeds, grasses and their roots. The bed thus prepared will be ready for the reception of seeds and small unsaleable roots as collected in the autumn, the season of ripening depending somewhat upon latitude.

"Ginseng berries are of a crimson color when ripe, each containing two seeds, produced in small clusters at the top of a central peduncle elevated above the principal leaves. When gathering the seed the roots may also be dug up, and all small and unsaleable ones preserved and replanted in the prepared bed. The seed should be rubbed from the pulp very carefully with the hand, and then sown, or better pressed into the ground with the finger about half an inch deep, and one every six inches along the row. The rows should be from one to two feet apart for convenience of removing weeds, should any appear. Both seeds and plants should be in the ground before hard frosts occur in autumn, for when these come the leaves of the large trees will fall on the bed and give the natural protection required.

"The following season no cultivation will be needed—if the bed is thinly covered with leaves—except to cut out sprouts and remove any large coarse weeds which may spring up from seeds or roots left in the ground. If winds blow away the leaves needed as a mulch, a few old dead branches of trees may be scattered about to hold the mulch in place. At the end of the third season the roots will have reached a marketable size and may then be dug, and the same bed worked over and restocked with seeds or small plants.

Some who have tried it say that raising ginseng can be made profitable where a man has suitable land in a forest or grove near at hand. The cost of preparing a bed cannot be very much and the seed can be obtained from the wild plants in our forests."

DISTRIBUTION. Ginseng has a wide distribution, and is found usually in upland woods and not in swamps, or low lying districts. It appears to thrive well in localities where limestone abounds. It frequently occurs in beds from which several pounds of roots may sometimes be gathered. As cattle are fond of the leaves it soon becomes scarce in woods to which they have ready access. It is comparatively common in Ontario where conditions are found favorable to its growth. Macoun, in his report on Canadian plants, gives it as found at the following places: Near Montreal, Beloeil Mountain, Prescott, Kingston Mills, Picton, Belleville, Seymour, Brighton, Sydney, Owen Sound, Amherstburg, London, Hamilton, Woodstock and Ottawa. It has lately been found near Toronto and occurs in many places as yet unreported.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXVI

VARIATIONS IN THE FAT OF MILK

BY H. H. DEAN, B.S.A., PROFESSOR OF DAIRY HUSBANDRY.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
June 22, 1891

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BULLETIN LXVI

VARIATIONS IN THE FAT OF MILK TAKEN AT INTERVALS FROM THE CITY OF GUELPH SUPPLY.

It has been stated on apparently good authority that milkmen who dip from the top of the can, or who draw from the bottom through a faucet, do not give to each customer his proper share of the fat or cream of the milk and that in the case of "dipping" those who receive theirs last get skim-milk. It having been demonstrated that where dipping is practised there is practically no difference in the amount of fat contained in different samples, we determined to see whether there is any difference when the milk is drawn from the bottom as in the case of three of the four milkmen of the city of Guelph whose milk was tested as here reported.

METHOD OF TESTING. The fat was determined with a Babcock tester. In every case the milk dealers were requested not to depart from their ordinary methods. In all twenty-five samples were taken with the following results:

MILKMAN NO. 1. June 2nd, 1891.

Sample.	Per cent. of fat.	Time.
No. 1	3.2	7.30 a.m.
" 2	3.2	8.40 "
" 3	3.1	9.50 "
" 4	2.95	11.00 "
" 5	3.05	12.20 p.m.

Remarks. (1). In this and in all the other cases the percentage of fat is the average of duplicates. (2). Sample No. 1 was taken from the bottom of the can after the milk had been driven about two miles, after it had been well stirred to ensure thorough mixing of the cream, and before any customers had been served. Nos. 2, 3 and 4 were taken at the time indicated from the bottom of the can without stirring as the milk was drawn for customers. No. 5 was taken from the last quart in the can. (3). Milk was carried in one large can (20 gals.); herd consisted of twenty-three cows which were on grass at the time; supplied one hundred and eighty customers.

Milkman No. 2. June 3rd.

Sample.	Per cent. of fat.	Time.
No. 1	2.6	9.07 a.m.
" 2	2.8	9.30 "
" 3	2.6	10.00 "
" 4	2.8	10.30 "
" 5	2.8	11.00 "

Remarks. (1). All these samples were taken from the bottom and without stirring, as a vessel containing ice which was floating in the milk prevented this being done. The milk had been driven only a few rods when the first sample was taken. (2). Milk carried in one can (15 gals.); herd numbered twenty cows which were kept in the stable and fed green feed; about one hundred customers.

Milkman No. 3. June 4th.

Sample.		Per cent. of fat.	Time.
No. 1 can	No. 1	3.2	8.00 a.m.
	" 2	3.2	8.00 "
No. 2 can	" 3	3.2	8.10 "
No. 1 can	" 4	3.2	9.00 "
No. 2 can	" 5	3.35	10 00 "
	" 6	3.4	11.00 "

Remarks. (1). No. 1 sample was taken from the top of the can after stirring before any customers had been served and after the milk had been driven about one-quarter of a mile. No. 2 sample was taken under the same conditions except that it was taken from the bottom of the can. All the other samples were taken from the bottom. (2). Milk was carried in two cans (12 gals. each); herd consisted of thirteen cows.

MILKMAN NO. 4. June 5th.

Sample.		Per cent. of fat.	Time.
No. 1 can	No. 1	3.55	6.20 a.m.
No. 2 can	" 2	3.40	6.20 "
	" 3	3.35	7.25 "
No. 1 can	" 4	3.35	7.30 "
No. 2 can	" 5	3.45	8.30 "
No. 1 can	" 6	3.20	8.30 "
	" 7	3.35	9.30 "
	" 8	3.25	10.30 "
	" 9	3.45	11.30 "

Remarks. (1). All these samples were taken from the top of the can. There were four cans (10 gals. each) and samples were taken from two only. Samples 1, 4, 6 and 7 were taken from can No. 1 before any customers received milk. Sample No. 1 was taken after stirring and No. 2 without stirring and before any customers had been served. Sample No. 8 was taken after the first customer had milk from No. 1 can, it having ridden for about four hours. Samples 9 and 5 were taken from the bottom of cans 1 and 2 respectively. (2). Milk had been carried three-quarters of a mile before first sample was taken; it was the previous evening's milk; herd of twenty cows; over two hundred customers.

CONCLUSIONS. Although there are some variations, yet they are so slight that from these trials we may conclude that there is practically no difference in the percentage of fat in the milk as ordinarily handled and served to customers at different times from the same can, whether it be taken from the top or from the bottom and that the motion and jarring of the waggon are sufficient to keep the fat or cream thoroughly mingled with the milk.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXVII

WINTER WHEAT EXPERIMENTS.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, ASSISTANT SUPERINTENDENT
OF EXPERIMENTS.

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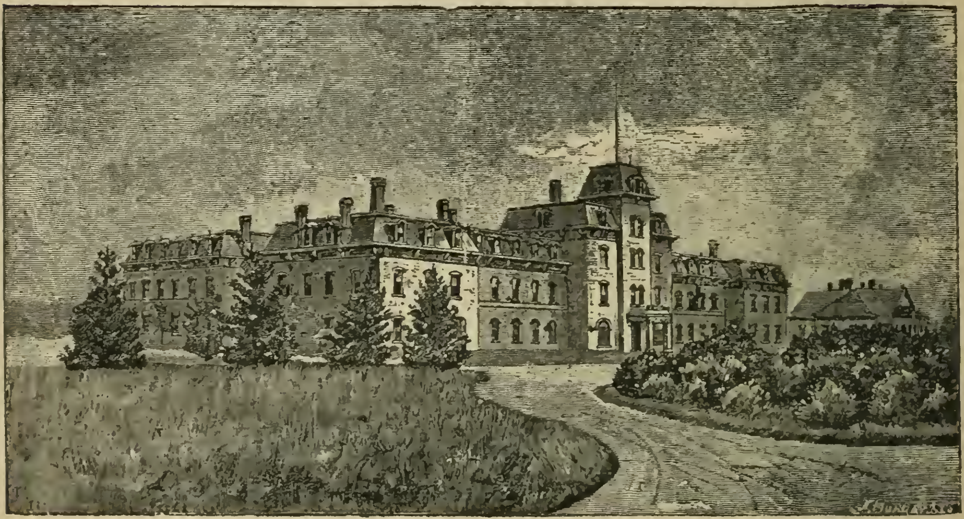

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BULLETIN LXVII.

EXPERIMENTS WITH WINTER WHEATS.

The winter wheat crop will always be one of considerable importance to Ontario notwithstanding the facilities for growing it in Manitoba and the Northwest. This view is supported by the following reasons along with other others which might be given :

1. A large portion of the province is well adapted to the growth of wheat. In view of this fact the advantage of growing a less amount than will suffice for home consumption is more than doubtful. Adaptability should always be a prime factor in determining the crops that should be grown. That winter wheat may still be grown in western Ontario in as fine form as in any country in the world has been amply demonstrated by the yields of the present year.

2. The winter wheat crop may with much advantage be made to form a prominent feature of a regular rotation.

3. This crop provides bedding for live stock more abundantly and more cheaply than any crop now grown. This feature alone adds much more to the value of the crop than is generally supposed.

4. It furnishes a crop suitable for sowing grasses along with it, a fact of no little significance in view of the probable decrease in the acreage of barley. It also admits of the autumn sowing of timothy which generally ensures a catch of the seed in any season.

5. The increased attention to stock production will tend to improve the yield per acre owing to the increase of fertilising materials which are thus made available to the farmer.

6. The growth of winter wheat tends to a more even distribution of labor throughout the year.

7. It encourages the manufacture of flour in the country, and this furnishes a plentiful supply of bran, which is almost indispensable for certain feeding purposes.

8. In growing winter wheat for home consumption the farmers always will have protection to the extent of the cost of conveyance from other provinces.

Our farmers should therefore continue to give careful attention to the growth of winter wheat in the parts of the province favorable to the same. The aim should be not so much to grow a large acreage as to adopt such methods of cultivation and to secure such varieties as are likely to give a large yield per acre. With this end in view the importance of good drainage, sowing at the right time and suitable conditions of soil in relation to rotation, fertility and natural adaptability cannot easily be over-estimated. All things considered it would be better not to sow winter wheat at all than to sow it under conditions not likely to produce a good crop.

SELECTION OF VARIETIES. In selecting varieties to sow, a careful regard must also be given to the wants of the millers. Those good yielding varieties only should be grown which are well adapted to milling purposes. Some years ago quantity was the great consideration with the grower. At present quality is at least equally important with quantity. This statement finds ample confirmation in the low price paid for the Wild Goose wheat notwithstanding its ample yields. The choice of the millers is not a mere arbitrary one. As in this fastidious age the tastes of the consumer rule, the miller must cater to those tastes or he will lose his custom. The consumer demands a beautifully appearing snowy white bread, and the miller must furnish flour that will produce it. In this we find one of the principal reasons for his preference for white wheats. The baker wants a strong flour, that is, one rich in gluten, and the miller must give it to him or he will cease to buy. Because of this the Manitoba Fyfe spring wheat stands high in favor with the millers. A heavy weighing wheat gives a larger percentage of flour than a light weighing one, hence the preference of the millers for the varieties which weigh the heaviest. The farmers therefore will do well to give diligent heed to the recommendations of the millers as to the varieties which stand high in favor with them, and in making their selections for sowing they should choose accordingly.

THE VARIETIES GROWN. There were in all some 70 plots of winter wheat grown at this station during the present year, including 51 varieties. A few of the varieties were grown in duplicate plots, and in another field we grew 10 varieties in acre and half acre plots. These larger plots, however, were simply duplicates of varieties grown in the smaller plots, with the exception of the Longberry Red, a variety introduced last year from Indiana, and which through some unfortunate oversight was not grown in the small plots. The details relating to the larger plots will be given in the annual report. Of the 51 varieties 24 were Canadian and American, and 27 were foreign. The foreign varieties came chiefly from Germany, England, France and Russia. As none of the foreign varieties have as yet proved equal to some of the Canadian and American kinds we do not feel justified at present in recommending them to be sown. This bulletin, therefore, gives the particulars relating to 23 Canadian and American varieties grown under exactly the same conditions.

General Classificaton of Varieties of Fall Wheats.

Bald Head.	White Chaff.	White Grain.	(2) Garfield or Natural Cross.
			(3) Surprise.
			(4) Canadian Velvet Chaff.
			(5) Bonnell or Landreth.
			(11) Winter Pearl.
			(14) Martin Amber.
		Red Grain.	(1) American Bronze.
			(9) Red Velvet Chaff.
			(10) Jones' Winter Fyfe.
			(12) Rogers.
			(19) Golden Drop.
			(23) New Monarch.
	Red Chaff.	White Grain.	(6) Seneca or Clawson.
			(7) Standard.
		Red Grain.	(8) Early Red Clawson.
			(16) Manchester.
Bearded Head.	White Chaff.	White Grain.	(17) Bulgarian.
			(22) Democrat.
		Red Grain.	(13) Egyptian.
	Red Chaff.	Red Grain.	(15) Golden Cross or Volunteer.
			(18) Red Lyon.
			(20) Hybrid Mediterranean.
			(21) Lancaster.

The above classification is based upon the recognition of all winter wheats as belonging to the bald or bearded varieties. But observe that those varieties with very short beards, often found only on the upper portion of the head, are classified as bald. The wheats in each of these general divisions are again classified according to the color of the grain. It should be borne in mind that sometimes we have white chaff with red wheat, and red chaff with white wheat. The finer distinctions of shade in color, as amber, bronze, etc., are not given in this classification, as they are liable to vary with a change of soil and climate. The number standing before the name of each variety gives the order of the yield of the said variety.

Location and Soil. All the varieties of winter wheat both native and foreign were grown in plots side by side in the same range. These plots contain exactly the one-fiftieth of an acre each. The aspect of the land is north-easterly, but the slope is very gentle. The soil may be termed a clay loam with good natural drainage.

Preparation of the Soil and Sowing. The soil was prepared on the bare fallow system as it was felt that a test of this nature should be made under the most favorable conditions attainable, to bring out to the fullest extent the capabilities of the grains grown. This is the only bare fallow that we had on the farm. The ground was plowed twice the previous summer. Additional surface cultivation was also given. Farmyard manure was applied at the rate of 15 tons to the acre.

Manner and Time of Seeding. The seed was sown by hand, as we have no machines suitable for sowing in drills in plots of the size mentioned. The plots were all sown September 4th with the exception of the Winter Pearl variety, which was sown on September 8th. The same amount of seed by weight was sown upon each plot, and it was sown at the rate of 1$\frac{2}{3}$ bushels per acre. As the location was favorable, the soil well prepared, the weather favorable from time of sowing until time of reaping and especially so during the ripening period, as there was no rust or blight to interfere with the filling of the grain, and as all the conditions were exactly similar and favorable to the most complete development, we may safely conclude that a more favorable opportunity for testing the full capabilities of those wheats when at their best could not easily have been furnished.

Table I shows the average yields of twenty-three varieties for 1891.

No.	Varieties.	Weight of grain per measured bushel.	Amount of straw per acre.	Yield of grain per acre (bush. 60 lb.)
		lb.	tons.	
1	American Bronze...... ..	63.00	2.16	65.2
2	Garfield or Natural Cross.	62.00	2.52	64.4
3	Surprise	63.25	1.99	63.8
4	Canadian Velvet Chaff ...	62.25	1.82	59.9
5	Bonnell or Landreth......	62.75	2.26	59.5
6	Seneca or Clawson..... ..	62.75	2.07	58.9
7	Standard	63.50	2.02	58.3
8	Early Red Clawson.......	62.50	1.93	58.3
9	Red Velvet Chaff.........	64.00	1.92	56.9
10	Jones' Winter Fyfe.......	64.25	1.77	56.3
11	Winter Pearl.............	61.00	2.51	55.5
12	Rogers...................	62.50	1.83	54.6
13	Egyptian	64.00	1.94	53.4
14	Martin Amber	61.00	2.13	50.4
15	Golden Cross or Volunteer.	64.00	2.17	49.9
16	Manchester	64.50	1.53	47.7
17	Bulgarian......	64.50	1.60	46.3
18	Red Lyon................	64.00	1.67	44.5
19	Golden Drop......	63.00	1.61	44.3
20	Hybrid Mediterranean....	64.25	1.92	44.0
21	Lancaster................	64.50	2.11	42.8
22	Democrat................	64.50	1.69	41.6
23	New Monarch............	63.50	1.72	40.8
	Average	63.28	1.95	52.93

It will be noticed that in the above table the 23 varieties of wheat mentioned have given most extraordinary yields, and produced wheat of an uncommonly good quality. The highest yield is from the American Bronze, which produced at the rate of 65.2 bush. per acre, and the lowest is from the New Monarch, which produced at the rate of 40.8 bush. per acre. The average yield of the 23 varieties is at the rate of 52.93 bush. per acre. The highest weight per bush. was 64½ lb., reached by several of the varieties; the lowest weight was 61 lb. per bush., and the average weight of the 23 varieties was 63.28 lb. per bush. In view of the extraordinary yields thus obtained, and the even more extraordinary weights of the grain, the curiosity is not unnatural which would desire to know whether these yields have a parallel on the continent of America.

It should be stated here that the weights of the different varieties of wheat, as given in the above table, were obtained from tests conducted at our request by Mr. James Goldie, Guelph, of James Goldie & Sons. When the weights were taken Mr. Goldie considered all the varieties sufficiently dry to grind, with but two or three exceptions.

DISCOUNTING THE YIELD. It may be well, also, to remark that yields such as the above would not have been obtained from whole fields of these respective varieties, nor could they be looked for from cultivation given under average conditions. Small plots yield more relatively than large ones, owing to cultivation around the borders and probably to other causes, and from this extra yield it has been thought that if one-fifth were deducted, the result would be a fair average to expect from a whole field under like conditions in other respects.

Table II gives comparative summary results :

Class.	Number varieties.	Weight per measured bushel.	Yield per acre. (Standard bushel by weight).
Bald	16	62.88	55.93
Bearded	7	64.25	46.07
White Chaff	15	63.03	54.19
Red Chaff	8	63.75	50.55
White Wheat	10	62.75	55.86
Red Wheat	13	63.71	50.68

From this table it is apparent that when wheat is grown under favorable conditions the bald varieties yield considerably more than the bearded, but that the bearded varieties weigh heavier on an average. It would be interesting to know how far these comparative results would be modified on soils less fertile and in seasons less propitious. The white chaff varieties were also the best yielders, but they did not quite equal the red chaff varieties in weight, and the white grain varieties also gave the highest yield per acre, but the red grain varieties were ahead in weight.

Table III gives many interesting particulars relating to the different varieties :

Number.	Variety.	Date of maturity.	Length of plant.	Width of 25 straws side by side.	Average length of 10 heads	Average No. of grains per head.	Weight of 1,000 grains, in grammes.
		July.	inches	mm.	inches.		
1	American Bronze	22	39	97	3.1	29.2	47.4
2	Garfield or Natural Cross	23	39	87	2.9	29.3	45.2
3	Surprise..............	21	38	87	3.0	33.1	41.8
4	Canadian Velvet Chaff	21	35	81	2.9	31.4	43.0
5	Bonnell or Landreth..	23	39	85	3.2	34.2	48.9
6	Seneca or Clawson....	23	39	78	3.1	30.9	42.4
7	Standard	22	36	91	2.7	35.1	39.3
8	Early Red Clawson...	20	37	91	2.7	26.4	48.3
9	Red Velvet Chaff .. .	23	39	87	2.9	30.1	43.1
10	Jones' Winter Fyfe...	22	38	83	2.8	34.1	39.6
11	Winter Pearl.........	24	40	78	3.7	30.5	49.7
12	Rogers................	23	36	74	3.1	30.6	43.5
13	Egyptian	21	44	83	2.8	29.4	40.5
14	Martin Amber........	23	38	78	3.3	37.4	47.2
15	Golden Cross or Volunteer	21	39	85	2.5	27.1	43.3
16	Manchester	22	37	73	2.8	28.8	41.1
17	Bulgarian	21	40	70	2.9	30.8	40.1
18	Red Lyon	21	38	70	2.5	22.6	44.2
19	Golden Drop	23	39	74	3.1	34.9	44.3
20	Hybrid Mediterranean	23	38	80	2.5	25.7	44.7
21	Lancaster	21	38	75	2.6	21.3	43.8
22	Democrat	22	40	72	2.7	27.2	40.1
23	New Monarch	22	37	80	3.2	32.2	41.4

From the foregoing table we learn that there were only four days of difference in the ripening of the 23 varieties. The greatest difference in the average length of the plant in the plots was only seven inches, and the average length of the plant in all the plots was 38.4 inches. The width of the straw is given in millimeters to give an idea of size and to some extent of its strength. As the straw in all the varieties stood fairly erect until the time of cutting, it would not be so easy perhaps to convey a correct idea in any other way. The average length of head was 2.9 inches, and the average number of grains per head was 30.1. From the column giving the weight in grammes of 1,000 grains of each variety, a somewhat accurate idea of the comparative size of the grains can be obtained.

The seed in 15 varieties was obtained from the College, and the balance as follows : Nos. 1, 8, 10, and 15 (Steele) ; Nos. 4 and 16 (Pearce) ; No. 11 (Wilkinson) and No. 13 (Gordon).

The color of the straw was white in all varieties, except Nos. 15 and 21, which were a deep slate, and Nos. 16, 18 and 20, which were a light slate.

The surface of chaff was smooth with the exception of the three velvet varieties, Nos. 4, 9 and 10.

In table IV. the yields of the 15 leading varieties for 1890 are given in comparison with the yields of the same for 1891 :

Varieties.	Weight of grain per measured bushel.			Yield of grain per acre in bushels of 60 ℔.		
	1891.	1890.	Average 1890-1.	1891.	1890.	Average 1890-1.
Surprise	63.3	58.7	61.0	63.8	29.6	46.7
Red Velvet Chaff	64.0	61.0	62.5	56.9	35.8	46 3
Bonnell or Landreth	62.8	61.0	61.9	59.5	32.1	45.8
Early Red Clawson	62.5	58.0	60.3	58.3	32.1	45.2
Standard	63.5	59.3	61.4	58.3	31.7	45.0
Rogers	62.5	60.8	61.7	54.6	34.6	44.6
Seneca or Clawson	62.8	59.0	60.9	58.9	25.4	42.1
Martin Amber	61.0	62.5	61.8	50.4	32.5	41.5
Golden Gross or Volunteer	64.0	58.3	61.2	49.9	32.1	41.0
Manchester	64.5	61.0	62.8	47.7	30.4	39.1
Golden Drop	63.0	61.2	62.1	44.3	32.5	38.4
Lancaster	64.5	61.7	63.1	42.8	33.3	38.1
Hybrid Mediterranean	64.3	60.2	62.2	44.0	32.1	38.1
Red Lyon	64.0	60.0	62.0	44.5	29.2	36.9
New Monarch	63.5	56.7	60.1	40 8	20.0	30.4
Averages	63.3	60.0	61.7	51.6	30.9	41.3

It will be observed that the Surprise heads the list, while as has been already stated it ranks high as a milling wheat The Red Velvet Chaff which stood first last year for yield and weight combined, is second in comparison for the two years, but drops down to ninth place in the list of 1891. It may also be observed that on the whole, the different varieties have given yields in much the same order for the two years. The average yield per acre for the two years, and the average weight per bushel, are certainly satisfactory. The former was no less than 43.1 bushels, and the latter 61.7 ℔.

REPORT OF THE DOMINION MILLERS' ASSOCIATION.

A deputation was appointed by the Dominion Millers' Association to visit this station, examine the different kinds of winter wheat and report upon the same. The deputation consisted of ten persons, including the President and Secretary of the Association. The visit was made on August 5th and the following is a summary of the report:

"The Committee are anxious to extend the growth of white wheat. They think very highly of the Surprise variety and advise farmers to sow it. They highly recommend the Canadian Velvet Chaff and regard it is a good milling wheat. They also consider the Bulgarian an extra good milling wheat.

"In regard to the red varieties they advise that the Rogers should not be sown as it is inclined to smut and contains no good milling properties. They also fear that the Manchester is a weak wheat for milling purposes, but this conclusion is only based on the grinding of small quantities. They consider the Jones' Winter Fyfe an extraordinarily good wheat for grinding, and they are of the opinion that if the farmers could raise it plentifully it would obviate the necessity of using so much Manitoba wheat. They very highly recommend the Hybrid Mediterranean, looking upon it as a good wheat, and they also highly recommend the Longberry Red."

More complete particulars regarding these wheats may be obtained from the report of the Millers' Association, which will doubtless have reached the public through the press before the issuing of this bulletin.

CONCLUSIONS.

The results of the experiments may be thus summarised:

1. The splendid returns obtained in this experiment prove that the capabilities of Ontario, as a wheat producing country, are still of a high order.
2. The bald wheats have on an average given 9.86 bushels more per acre, or 21.42 per cent. than the bearded varieties, but the latter have weighed on an average 1.37 lb. more per bushel.
3. The white wheats have given an average of 5.18 bushels more per acre than the red wheats, and they also stand higher in the estimation of the millers than the latter.
4. The bald white chaff white wheats gave an average of 13.6 bushels per acre more than the bearded red chaff red wheats.
5. The seven leading varieties in point of yield were all white wheats except the American Bronze.
6. These experiments tend to confirm the popular opinion that white wheats under favorable condition will give more bountiful returns than red wheats, and that the same may be said of the bald varieties as contrasted with the bearded.
7. The four best yielding white wheats for 1891 were the Garfield, Surprise, Canadian Velvet Chaff and Bonnell; and the four best yielding varieties of red wheat were the American Bronze,

Early Red Clawson, Red Velvet Chaff and Jones' Winter Fyfe, in the order named in both instances.

8. The best four weighing varieties were the Manchester, Bulgarian, Lancaster and Democrat, each of which gave 64½ lb. per bushel.

9. The three velvet chaff varieties gave an average yield of 4.77 bushels per acre in excess of the mean average of the 23 varieties, and weighed .22 lb. more per bushel, and they are also included in the leading varieties mentioned in conclusion 7.

10. Of the varieties enumerated in this bulletin, the Dominion Millers' Association recommend the following as the most serviceable for milling purposes, viz., of the white wheats, the Surprise, Canadian Velvet Chaff and Bulgarian; and of the red wheats, the Jones' Winter Fyfe, the Hybrid Mediterranean and the Longberry Red.

DISTRIBUTION OF SEED.

As we have received many enquiries regarding seed, we append the following in reference to the mode of distribution that we have decided to adopt: We will supply any of the following varieties, viz., the Surprise, Red Velvet Chaff, Bonnell or Landreth, Early Red Clawson, Bulgarian, Garfield, American Bronze and Canadian Velvet Chaff in one bushel and half bushel lots. As we have only a limited quantity of the seed of each of these varieties, we can only furnish seed while the supply lasts and in the order in which we receive the applications. The prices charged will be moderate. For further information apply to the Professor of Agriculture.

The varieties will be distributed in smaller lots through the medium of the Ontario Agricultural and Experimental Uuion. The Experimental Union, which meets annually at the Agricultural College, is composed of the officers, ex-students and students of the college, and all farmers throughout the province are invited to co-operate in the work that is being carried on by the Association. This work consists of the testing of seeds and fertilisers, under conditions as nearly similar as can be found practicable. The seeds are furnished by the Union free to the farmers, and full instructions regarding the mode of conducting the tests are also furnished at the same time. The only return asked of the farmer is a report of the results, to be sent after harvest by a time fixed upon as mentioned in the instruction sheet. These reports are made upon blank forms furnished to each experimenter along with the instructions.

At the present time there are no less than 1,642 plots under experiment, which are conducted by ex-students and other farmers throughout the province. These plots comprise the following:—70 with fertilisers, 196 with lucerne and corn, 350 with roots, 1,026 with spring wheats.

The results of this work, which are published annually, cannot fail to be of immense service to the farmers.

In the subjoined table will be found the different sets of varieties of wheats, which will be furnished by mail in half pound lots of each variety, to farmers applying for them, and in the order of the applications so long as the supply lasts.

Five Sets of Fall Wheat for Co-operative Tests

(1)	(2)	(3)	(4)	(5)
American Bronze. Canadian Velvet Chaff. Surprise. Manchester. Bulgarian.	American Bronze. Canadian Velvet Chaff. Garfield. Golden Cross. Standard.	American Bronze. Canadian Velvet Chaff. Bonnell. Early Red Clawson. Lancaster.	American Bronze. Canadian Velvet Chaff. Winter Pearl. Red Velvet Chaff. Hybrid Mediterranean.	American Bronze. Canadian Velvet Chaff. Longberry Red. Jones' Winter Fyfe. Democrat.

Each farmer wishing one of these sets will please address to the Secretary, C. A. Zavitz, Experiment Station, Guelph, *mentioning which set he desires*, and the grain, instructions for testing and blank forms on which to report will be forwarded to his address.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXVIII

FEEDING SHORN AND UNSHORN LAMBS IN WINTER.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, EXPERIMENTALIST.

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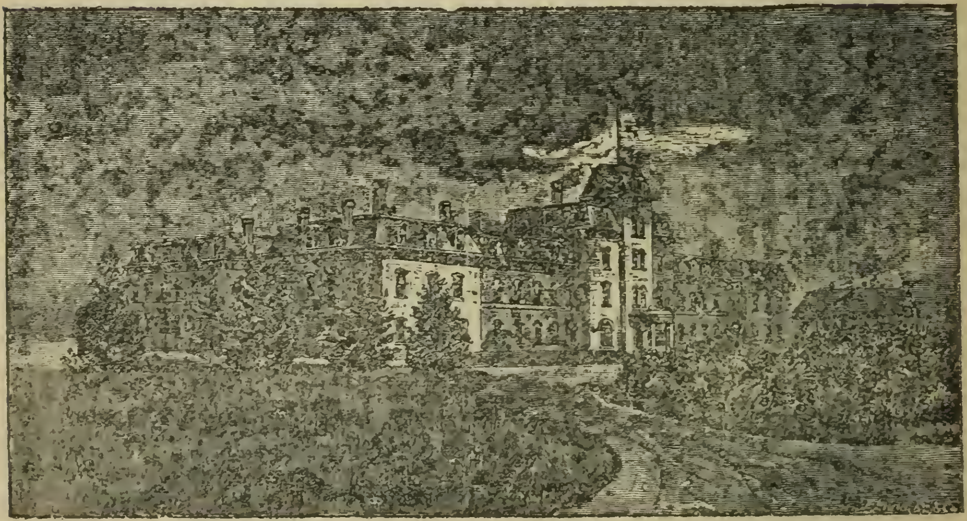

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BULLETIN LXVIII.

FEEDING SHORN AND UNSHORN LAMBS IN WINTER.

This experiment began on January 6, 1891, and closed on April 29 following, thus covering a period of 113 days. The objects of the experiment include the following, viz: 1. To ascertain whether shorn lambs or unshorn lambs will give the best returns for the food consumed in winter. 2. To ascertain the relative gains that will result from liberal feeding at such a time. 3. To ascertain the cost of feeding lambs for fattening purposes in the winter season on the ration used in this experiment. 4. To ascertain the adaptability of the work to the conditions of Ontario.

THE ANIMALS SELECTED. During the early part of October, 1890, as stated more fully in the report of the College for that year (pp. 130-132), 537 sheep and lambs were purchased and brought to the farm to be fattened; of these 505 were lambs. From the lambs 100 were selected and shorn early in October with a view to fattening them for the British market during the winter months. The particulars relating to these will be fully given in a Bulletin which is the complement of this one. Subsequently 20 others were selected, and of these 10 were shorn, the remaining 10 retaining their fleeces until after the close of the experiment. The animals used in this experiment were therefore the second choice, as 100 had previously been seleted from the whole lot. They were good grade lambs of both sexes, but the males were all wethers. The breeding was mixed, no accurate particulars were obtained regarding it, but judging from the appearance of the animals they were the offspring of the common ewes, and from pure rams of the various long and short wool varieties used in the country, as the Leicester, Cotswold, Oxford-Down, Shropshire and Southdown, but the Leicester blood evidently predominated. Some of the animals would have passed for pure Leicesters. They were in fair condition at the commencement of the experiment, so much so that they would have readily sold at that time for the American market at the price at which they were valued, viz, 5 cents per pound live weight.

PERIOD OF PREPARATION. At the close of November, 10 of the lambs were shorn. They were all then placed in the same pen on December 2, and were fed together until January 6, when the experiment proper commenced. The long preparatory period to which they were thus subjected gave the animals composing the two lots an even chance on entering the experiment. At the commencement of this preparatory period the weights were as follows:

	Aggregate weight.	Average weight.
20 lambs, shorn and unshorn..	1,936.50 ℔	96.83 ℔
10 lambs, unshorn............	1,018 50 "	101.85 "
10 lambs, shorn..............	918.00 "	91.80 "

The wool from the 10 shorn lambs weighed 45.31 pounds and was sold at 13 cents per pound. In development therefore, there was a slight advantage in favor of the 10 unshorn lambs.

CONDITIONS GOVERNING EXPERIMENT. 1. The unshorn and shorn lambs, designated groups 1 and 2 respectively, were put in separate pens on January 6, when the experiment commenced and were kept in these until it closed. These pens were in a closed shed, with ceiling 10½ feet high, and hay loft overhead. The pens were 24⅔ feet long and 13½ feet wide. The length of manger was 20½ feet, which gave practically 2 feet to each sheep, and this was found to be sufficient. In the rear and front of each there was a window, and also in front were double doors, each 3 feet wide and cut in two across the centre. The top doors were kept constantly shut except on fine sunny days. The bottom doors were kept constantly open for the unshorn lot day and night, unless when very stormy, and for the shorn group they were kept open only in fine weather in the cold months. The pens opened into yards facing the south-west. These yards were 28½ feet long and 13½ feet broad. To have the yards facing the south or south-east would be preferable, but in this instance the play of west and south-westerly winds is arrested by the barn. 2. Both groups were given the same kinds of food and the same quantities throughout the experiment, except in the case of hay, of which they were given all they would take. Of this, however, the two groups took the same amount. 3. The lambs in each lot were weighed monthly throughout the experiment, except in the case of the last weighing, which of necessity had to be made before the month had expired, as these lambs formed part of the lot shipped to England early in May. These weights are given singly in Table I of this bulletin.

Food and Feeding. The food fed to the lambs throughout the experiment consisted of hay, grain, bran and roots. The hay was composed of mixed grasses, the common red clover predominating. It was fed uncut. The grain ration was made up of three parts oats, two parts pease, and one part bran, by weight. The oats and pease were fed whole. The roots included both turnips and mangels, but these were not fed together. They were sliced before feeding them. The food was given in two feeds per day, morning and evening. The water was so furnished from taps in the pens, that the lambs could virtually partake of it at will.

Estimated Value of the Food. The food was estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. These conditions relate to the size of the farm, its distance from market, and the state of the roads. The average market price for oats was 40 cents per bushel, for pease 60 cents, for bran $14.00 per ton, for roots 11½ cents per bushel, and for hay $7.00 per ton. A careful estimate was made of the cost of marketing under the conditions named above. In the case of the grain it included the cleaning, and also took into account the difference between the quality of grain as usually fed and as prepared for market. The estimate was made on the basis of hired labor for man and team. The cost of marketing these respective foods was thus found to be in the case of oats, 5½ cents per bushel, pease 8 cents, roots 4½ cents, and hay $2.50 per ton. One cent per bushel was charged for slicing the roots. The home value of the food components was therefore as follows: Oats 34½ cents per bushel, pease 52 cents, bran $14.00 per ton, roots, when sliced, 8 cents per bushel, and hay $4.50 per ton.

Food Eaten. The total amount of food eaten by the lambs of each group was practically the same during the experiment. Each group consumed 2,136 lb. grain and bran, 2,167 lb. hay, 5,615 lb. roots. The amount of food eaten by each lamb per day on an average throughout the experiment was therefore:

Oats	.95 lb.	1.90 lb. grain and bran
Pease	.63 "	
Bran	.32 "	
Hay		1.91 "
Roots		5.00 "
Total		8.81 "

At the end of the first month or period, a slight increase was made in the quantity of the grain ration given. This was the only change that was made in the quantity of food fed, but it should be remembered that all the hay was given that the lambs would eat.

WEIGHTS. Table I gives the weights of individual animals at the commencement and close of the experiment.

Group 1.			Group 2.		
Weight of each animal		Individual increase during the experiment.	Weight of each animal		Individual increase during the experiment.
At commencement of test.	At close of test.		At commencement of test.	At close of test.	
lb.	lb.	lb.	lb.	lb.	lb.
132.5	184.0	51.5	94.0	164.0	70.0
116.0	162.5	46.5	111.0	169.0	58.0
105.0	149.0	44.0	105.5	151.0	45.5
103.5	147.5	44.0	104.0	149.0	45.0
110.5	153.5	43.0	107.5	148.5	41.0
130.0	171.5	41.5	90.0	129.5	39.5
117.5	158.0	40.5	94.0	130.0	36.0
104.0	144.5	40.5	103.5	139.0	35.5
107.0	146.0	39.0	113.0	144.0	31.0
93.0	129.0	36.0	106.0	132.0	26.0

It will be observed that there is a wide difference in the gains made by individual lambs. The highest increase made by one animal during the experiment was 70 lb., a daily gain of .62 lb. The lowest gain was only 26 lb., a daily gain of but .23 lb. The five lambs in each group which gave the highest increase in weight gained .43 lb. per day, and the five which gave the lowest increase gained but .32 lb. per day. The profits therefore in all probability came largely from the lambs which made the best daily gains. But to be quite clear on this point, we would require to know the food consumed by each lamb. The marked difference in the gains, however, emphasises the importance of making careful selections when lambs are to be fattened.

Table II gives a summary and an analysis of weights.

———	Unshorn lambs.	Shorn lambs.
	lb.	lb.
Weight at commencement	1119.000	1028.500
Weight at close	1545.500	1456.000
Increase per group	426.500	427.500
Average daily increase per group	3.774	3.783
Average individual increase	42,1650	42.750
Average individual daily increase	.377	.378

The average daily gain of the lambs in the two groups was practically the same, there being but one pound of difference in favor of the shorn lambs. This difference would probably have been more had the lambs been shorn earlier in the season. The average daily gain of each lamb was .38 lb. or nearly $\frac{2}{5}$ pound per day.

VALUES. Table III gives the financial results of the experiment.

——	Unshorn lambs.	Shorn lambs.
Value of animals at commencement of test.	$55 95	$51 42
Cost of Shearing	....	50
Cost of Food	31 45	31 45
Cost of attendance	2 82	2 82
Total Cost	**$90 22**	**$86 19**
Value of animals at close of test	$108 18	$101 92
Value of wool	....	5 93
Value of manure	8 48	8 48
Total Value	**$116 66**	**$116 33**
Gain	**26 44**	**30 14**
Gain per cent. on Investment.....	**29.31**	**34.97**

The lambs were valued at five cents per pound at the commencement of the experiment, as stated elsewhere. At its close they were valued at seven cents per pound, as we were offered this sum by Mr. L. O. Barber, live stock dealer, of Guelph. It is only fair to state here that this is more than has hitherto been paid for lambs at that season of the year. The offer was refused, as we desired to ship some of them to Great Britain, along with a number more fed for that purpose, to make the number so shipped an even hundred. Full particulars are given regarding the feeding of these lambs and the shipment of the same in bulletin LXIX.

The manure was valued at $\frac{3}{4}$ of a cent per day per lamb. This estimate is based upon the results of an experiment conducted by Prof. I. P. Roberts, of Cornell University experiment station, New York, wherein the value of the manure made from one sheep per day is reckoned at one and a half cents. For reasons which we do not stay to mention now, we consider the estimate referred to too high to apply to Ontario conditions. We have therefore put the value of the manure as stated above.

The cost of attendance was reckoned on the basis that one man would feed and care for 400 lambs per day under ordinary conditions when the food has all been made ready. This estimate is probably very near the truth. At all events it is not an extravagant one, as anyone who has engaged in this work must know very well. It will be observed that the gain on the shorn lambs was $3.70 more than on those unshorn. But too much should not be made of this at present, as in the offer for the lambs no distinction was made between those shorn and unshorn. It is important, however, to note that the shorn lambs shipped better than the unshorn, as will be more fully stated in the bulletin relating to the whole lot which were exported to Great Britain. The total average gain on the investment during the 113 days which the experiment lasted, viz., 32.07 per cent., is a very satisfactory one.

A few of the lambs in this experiment were sent to England, to take the place of others in the larger experiment which were not considered suitable, hence the difficulty of giving the actual returns realised. Should the price offered for these lambs be considered unduly high, the reader can estimate values based upon the current prices in his neighborhood.

CONCLUSIONS. The following are the chief of the conclusions to be deduced from this experiment:

1. That good grade lambs when being fattened in winter will make satisfactory gains on a daily ration of 1.90 lb. grain and bran, 1.91 lb. hay and 5 lb. roots, or a total of 8.81 lb.

2. That lambs when properly fed and cared for in the winter, the ration being the same as that used in this experiment, will make an average gain per day of .38 or nearly 2-5 lb.

3. That good grade lambs may be made to gain .38 lb. per day at an outlay of 2.78 cents per day for food, when the prices are the same as those charged in this experiment.

4. That there is some advantage to be derived from shearing lambs in autumn for winter feeding, although the extent of the advantage was not very marked in the experiment.

5. That about 12 per cent. represents the relation which the value of the wool when shorn bears to that of the animal under conditions similar to those which relate to this experiment.

6. That when good grade lambs are fattened in winter, the prices of mutton and food being the same as in this experiment, a profit of 32.07 per cent. may be realised on 113 days' feeding.

7. That as the lambs in this experiment cost $3.76 when laid down at the farm and would bring $10.80 per head at the close of the experiment, the advance in value was $7.04 per head, that is to say, they were worth nearly three times as much as they cost in the first place.

8. Inasmuch as the opinion has very generally prevailed among farmers that lambs cannot be fattened in the winter at a profit, in view of the above this opinion should be carefully reconsidered.

ONTARIO AGRICULTURAL COLLEGE
EXPERIMENT STATION

BULLETIN LXIX.

FATTENING LAMBS FOR THE BRITISH MARKET.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, EXPERIMENTALIST.

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Hon. John Dryden, Toronto.

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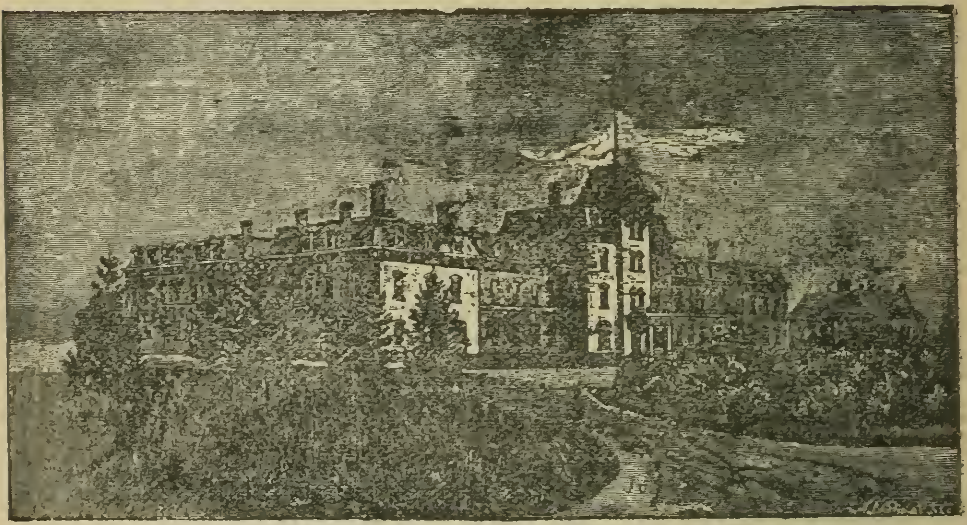

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BULLETIN LXIX.

FATTENING LAMBS FOR THE BRITISH MARKET.

This experiment began on Oct. 24, 1890, and closed on April 24, 1891, seven days before the lambs were shipped to Britain. It therefore covered a period of 182 days. The principal objects of the experiment were: 1. To ascertain whether lambs can be fattened at a profit in winter for the English market, in the hope of adding another important industry to the agriculture of Canada. 2. To ascertain the suitability of the average grade lambs of Ontario for the said market; and 3. To ascertain whether autumn shorn lambs are the more suitable for spring shipment.

THE ANIMALS SELECTED. The lambs from which those intended for shipment were selected were purchased by Mr. J. E. Storey, the farm foreman, in the eastern part of Ontario. There were purchased in all 505 grade lambs. Of these 312 came from the counties of Lanark and Carleton, 145 from Pontypool in the county of Durham, and 48 from Wellington and the adjoining counties. The last lot mentioned reached the farm during the latter part of September, those from Lanark and Carleton on October 4, and those from Pontypool on October 18. The lambs were a mixed lot, and take them all in all were somewhat below the average, as when they were purchased good lambs were hard to get. They were evidently the offspring of sires of the principal breeds which we have in the country. Each lot of lambs was turned into the rape fields and fed upon the rape until October 20, when one hundred of them were chosen for the experiment. In selecting, compact medium-sized animals were chosen, and especially those having dark faces so far as they could be obtained. Notwithstanding, a considerable number were not of this class. The most ungainly ones, therefore, were counted out, and but ninety of the lambs were included in the experiment proper. Interesting particulars regarding those counted out will be appended in the annual report.

CONDITIONS GOVERNING THE EXPERIMENT. 1. The lambs selected were shorn Oct. 22 and 23. On October 24 they were all weighed separately and the weights recorded. They were then kept housed in sheds in cold and rough weather, and were allowed to pasture on the rape in the day time when the weather was fine, until November 21. After that date they were confined to the sheds and the yards in front of them. The sheds, or rather shed, consisted of one large building with ceiling 10½ feet high and hay loft overhead. This building was divided into compartments about the same in size as those described in Bulletin No. LXVIII. The yards in front were also similar, and the general treatment of the lambs as to confinement or exposure was about the same as with those in the aforementioned bulletin. Some 16 or 17 animals were kept in each compartment. We considered them a little overcrowded, especially when they were feeding.

FOOD AND FEEDING. From October 24, the date of the first weighing, until November 21, they were fed hay and a limited amount of grain in addition to the rape which they secured in the field. The grain ration was gradually increased during this period. From November 21, 1890, until April 24, 1891, when the experiment closed, they were given a ration consisting of grain, roots and hay. The grain fed was accurately weighed. The whole amount consumed was—oats, 12,408 lb.; oat screenings, 1,062 lb.; pease, 4,712 lb.; bran, 1,777 lb. A small amount of damaged wheat fed is included in the reckoning for the pease. The ration thus formed was practically as follows: Oats, 7 parts; oat screenings, 1 part; pease, 3 parts; and bran, 1 part by weight. The grain was fed in the unground state. The quantity of the grain fed was increased from time to time, and the average amount consumed per day by each animal throughout the experiment was 1.3 lb. The lambs were given all the hay they would eat. It consisted of clover and timothy, but the principal portion was clover. The hay fed in this experiment was not weighed, but as another experiment was being carried on simultaneously in the same building, with lambs of similar character and very similarly fed, in which the hay ration was accurately weighed (see Bulletin LXVIII), we have used these weights in estimating the amount of hay consumed in this experiment. This estimate would put the whole of the hay consumed at 13.9 tons, and the average amount consumed per day by each animal at 1.91 lb. The roots consisted of turnips sliced in strips before being fed. The amount at first given to each animal per day was 1 lb. This was increased from time to time until February 12, when they were given 5 lb. each per day, and this was the quantity given until the close of the experiment. The whole amount of the roots fed therefore was 50,301 lb., or 838⅓ bush.; or, an average per day for each animal of 3.07 lb. They were supplied with water from taps in the pens.

ESTIMATED VALUE OF THE FOOD. The food was estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions (see

Bulletin LXVIII). The home value put upon the food by this mode of reckoning was: Oats, 34½ cents per bush.; pease, 52 cents; bran $14 per ton; roots sliced, 8 cents per bush.; and hay, $4.50 per ton.

WEIGHTS. Table I gives a summary and an analysis of weights:

——	Pounds.
Weight at commencement	7,636.500
Weight at close	12,150.000
Weight of increase	4,513.500
Average increase per head	50.150
Average daily increase per head	.275

The average weight of each lamb at the commencement of the experiment was 84.85 lb., and at its close 135 lb. The average gain per month therefore was 8 25 lb. The highest average gain per month was 11.70 lb., and the lowest 5.40 lb.

TRANSPORTATION. The lambs were put on board the cars on May 1. The farm foreman took charge of them as far as Montreal, put them on board the steamship Lake Superior *en route* for Liverpool, and secured a competent feeder to care for them. The whole number of lambs sent was 100. To make up this number the 10 lambs described in Group 1, Bulletin LXVIII were added. Of these 5 were left with long wool and 5 were shorn just before shipment. They were thus chosen first, to make the number exactly 100, and second, that some lambs might be included newly shorn and others possessed of long wool. The best of the lambs in those two groups were kept at home to be fed for show purposes. They have since been sold to be shown at the approaching fat stock show in Chicago. The shipment reached Liverpool in good condition and without the loss of a single lamb. The autumn shorn lambs stood the voyage better than those shorn in the spring, and also better than those not shorn, as the second lot mentioned suffered from cold and the third from heat. It may also be mentioned here that the autumn shorn lambs occupied considerably less space than those in full fleece when on board the vessel, and on their arrival they were in more attractive form than either of the other lots.

DISPOSAL OF THE LAMBS. They were consigned to Messrs. Bater and Williamson, live stock commission agents, Liverpool, to be disposed of. Mr. G. F. Frankland, ex-Alderman, Toronto, who was in Liverpool at the time, was also authorised to take notes of and report upon the same. Mr. Frankland reported: 1. That the lambs as a whole arrived in excellent condition. 2. That English buyers pronounced them one of the best lots of lambs ever sent from Canada to England. 3. That they killed well, dressing 68½ lb. each, or a little more than half the live weight, which "is considered a good return, more especially after a journey of over 3,000 miles by land and sea;" and 4. That when dressed the meat brought 17 cents per pound, "the highest quotation" at the time in the wholesale market.

VALUES. Table II gives the financial results of the experiment.

——	Values.
	$ c.
Value of the animals at the commencement of the test	362 73
Cost of shearing ..	4 50
Cost of food	339 62
Cost of attendance	40 95
Cost of shipping to England	375 21
Total cost	**1,123 01**
Value of lambs in England	1,061 08
Value of wool	47 50
Value of manure	122 85
Total value	**1,231 43**
Gain	**108 42**
Gain per cent. on investment	9.65

The average value of the lambs at the commencement of the experiment was $4.03, and the average price for which they were sold in the English market was $11.79. The average advance in value, therefore, was $7.76. The cost of attendance was estimated as in Bulletin LXVIII, on the assumption that one man would care for 400 lambs. The autumn shorn wool averaged 4.06 lb. per fleece unwashed, and sold for 13 cents per pound. The value put upon the manure as in Bulletin LXVIII was ¾ ct. per animal per day, one-half the amount fixed upon by Professor Roberts, of Cornell University, in a bulletin issued during the present year.

The cost of transportation and sale of the lambs was $375.21 or $4.17 per head. This was considerably more than the average outlay, which experienced shippers put at from $2.50 to $3.00 per head. This arose in part from the smallness of the shipment, which of necessity would involve more expense relatively than when done on a large scale. It is confidently believed that the cost of transportation and sale will be much reduced in the next shipment. If, in this shipment, $2.75 which is about the average cost, were charged against the lambs for shipment and sale, the financial results would be as follows :

Total cost of lambs	$995 30
Total value as before	$1,231 43
Net gain	$236 13
Gain per cent. on the investment	23.72 per cent.

It is the intention to repeat the experiment the coming winter and spring.

Conclusions. The leading conclusions to be drawn from this experiment include the following :

1. That lambs can be fattened successfully in winter in considerable numbers in one building when subdivided into moderately sized groups.

2. That average grade lambs will fatten satisfactorily in autumn and winter when fed daily a ration consisting of some rape for a time, 1.30 lb. grain, 1.91 lb. hay, and 3.07 lb. roots.

3. That average grade lambs when fed in winter similarly to those in this experiment will make a gain of 50 lb. in six months, that is to say, .275 lb. per day, or 8.25 lb. per month.

4. That with the prices charged in this experiment, average grade lambs can be fattened in winter at a daily cost of 2.07 cents for food.

5. That autumn shorn lambs are the most suitable for spring shipment, as they occupy less space on shipboard, they better resist changes of weather and present a more attractive appearance in the market.

6. That it will pay to ship lambs to Britain at an advance of 2 cents per pound, live weight, over what can be obtained here, but the price obtained in Britain last season was not quite equal to 7 cents per pound, live weight, in Ontario.

7. That there is room for a large and profitable trade in fat grade lambs between Canada and Britain providing they are shipped early in the season.

ONTARIO AGRICULTURAL COLLEGE
EXPERIMENT STATION

BULLETIN LXX.

FEEDING GRADE STEERS OF DIFFERENT BREEDS

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, EXPERIMENTALIST.

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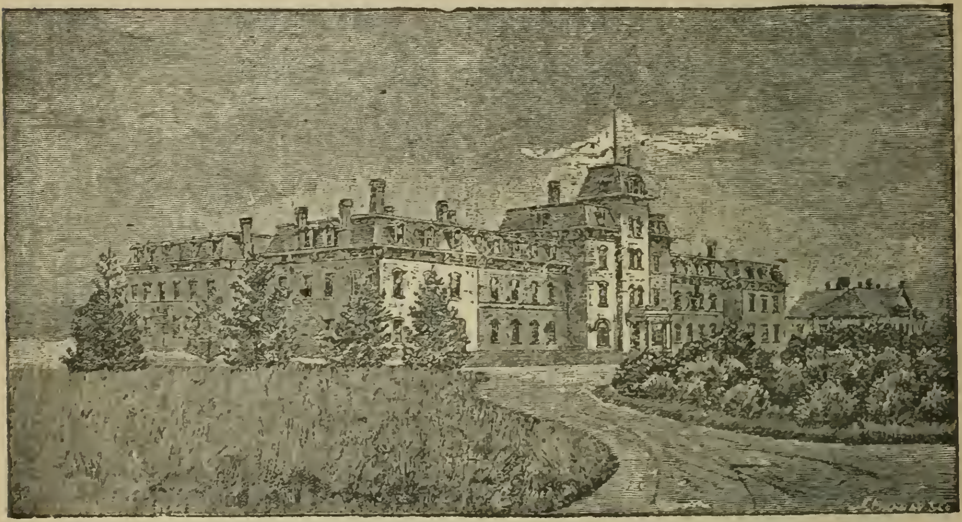

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BULLETIN LXX.

FEEDING GRADE STEERS OF DIFFERENT BREEDS

This experiment consists in the rearing of grade animals of different breeds from birth to early maturity. The animals were chosen from breeds whose fitness for beef production has been recognised to some extent by at least some sections of the community. The experiment commenced in the autumn of 1889 and will be completed in its main features when the animals have reached the age of two years. The portion of it covered by this bulletin brings them only to the completion of their first year.

The primary objects of the experiment were to ascertain :—1. The average cost of rearing grade steers, for purposes of beef production, from birth until the period of early maturity, when fed upon a heavy or forcing ration. 2. The comparative cost of rearing grade steers on whole and skim milk respectively, and the effects of these on development after the termination of the milk period of feeding. 3. The comparative cost of producing beef from well-graded and native or scrub animals respectively. The chief of the secondary objects were to ascertain :—1. The relative cost of rearing animals for beef production during different periods of growth when fed upon a heavy ration. 2. The relative daily gains ; and 3. The total relative increase in weight.

In the effort to secure these objects it was thought that if grade animals were secured of the different breeds which to a greater or less extent have been used for making beef, that the results would be even more valuable than if they were of the same grade. They were secured therefore on this basis.

THE ANIMALS SELECTED. The animals secured, eight in number, were obtained from leading breeders and wherever they could be got of a suitable character. Each individual was the offspring of a pure registered sire, except in the case of the native or scrub, and the aim was in every instance, except in that of the native, to have the dam a common grade cow. The effort to secure them as near the birth period as possible was also fairly successful, except in the case of the Galloway grade, which was fifty-three days old when it reached the farm. The Shorthorn grade to which was fed whole milk was fourteen days old, and the others were all less than nine days old. The more important particulars regarding these animals are given in the subjoined table. The color generally speaking was typical of the breed of the sire.

Table I gives particulars regarding the breeding and the leading characteristics of the different animals :

Grade.	Date when calved.	Sire.	Dam.	Characteristics of steers.
Galloway...	Nov. 2, 1889	Rajah of Brooke (3970).	$\frac{1}{8}$ Shorthorn and $\frac{7}{8}$ Canadian.	Short legs and blocky frame.
Shorthorn ..	Dec. 22, 1889	Methlick Hero, =2723= (imp.)	A Shorthorn grade.	Rather leggy for Shorthorn type.
Aberdeen Poll.	Jan. 1, 1890	Runnymede 2nd, 5220.	A common two-year-old heifer.	Not robustly developed.
Hereford ...	Jan. 5, 1890	King Hal.	A good common cow.	Short legs and heavy body.
Devon	Jan. 8, 1890	Duke (947)	A Shorthorn grade.	Neatly and squarely built frame.
Holstein ...	Feb. 17, 1890	African Prince, (H. F. H. B.) 1270.	A common cow.	Large sized and rather coarse in the bone.
Shorthorn ..	April 1, 1890	Macduff..... ..	A Shorthorn grade.	Medium size and neatly built frame.
Native or scrub.	April 16, 1890	A native bull of the rangey type.	A three-year-old native.	Narrow bodied, flat ribbed and long legged.

FOOD AND FEEDING. Milk was fed to each of the animals until six months old. Of this they were given a fair allowance, but not all they would take. They were all given whole milk as stated in Table II, except one of the Shorthorn grades, which was fed skim milk. They were fed by hand morning and evening. The skim milk was warmed by heating before being fed. The adjuncts fed in addition to the milk were clovery hay cut, green fodder in the season, and meal consisting of equal proportions by weight of peas, oats, wheat screenings and bran. None of the meal was given along with the milk. During the second six months they were fed hay, green food, roots and meal. The hay was similar in kind to that mentioned above. The green fodder consisted of oats and peas, clover and millet, as these crops came in season. The roots comprised turnips and mangels. They were not fed at the same time and were sliced before being fed. The meal during the first three months of this period consisted of peas, oats and wheat screenings ground, bran and oil cake in the proportions of 4, 4, 4, 4, and 3 parts respectively. During the next three months they received a meal ration of pease and oats ground and bran, in the proportions of 2, 2 and 1 respectively. The meal throughout was fed dry, along with the hay, which was cut. The aim was to give each animal about the same quantity of meal, but some would not take so much as others, which accounts for the difference in the amount eaten as given in the subjoined table. The food was given in three meals per day, and they virtually had access to water at will. The animals were kept in box stalls until they were about six months old. After that time they were tied in stalls and were allowed to exercise about one hour daily in the barnyard. The first six months will be referred to hereafter in this bulletin, for the sake of convenience, as the first or milk period, and the next six months as the second period.

FOOD EATEN. It will be observed in the subjoined table that the consumption of food was large, more especially with the more concentrated and costly rations, as milk and meal, but this was in keeping with the objects of the experiment, as already expressed. The kinds of meal fed were doubtless too concentrated and costly, and the quantities too large to give the best results financially.

Table II gives the consumption of food during the first and second periods respectively :

Grades.	First six months.				Second six months.			
	Milk.	Hay.	Meal.	Green fodder.	Hay.	Meal.	Green fodder.	Roots.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Galloway	2091.5	215.5	281.5	20.0	721	1489	826	511
Shorthorn	4383.6	107.0	196.5	68.0	855	1779	615	1575
Aberdeen Poll	4182.2	113.0	195.5	57.0	717	1500	857	906
Hereford	4154.0	140.0	243.5	66.0	788	1754	561	1500
Devon	3611.4	112.0	134.5	70.5	912	1682	548	1541
Holstein	4475.5	110.0	190.5	125.5	884	1744	219	2377
Average (six animals).	3816.4	132.9	207.0	67.8	812.8	1658	604.3	1401.7
*Shorthorn	4691.5	175.5	188.0	212.0	1059	1652	.....	3261
Scrub or native	3761.7	71.5	92.4	148.0	757	1246	....	2898

* Fed on skim milk.

It has been already mentioned that the Galloway grade did not reach the farm until 53 days old. Prior to that time he was suckled by the dam. The estimate for the consumption of whole milk by this animal during that period was the average of the consumption by all the other animals which were given this ration. It will be noticed that the total consumption of milk by this calf was small relatively. This was owing to the fact that he would not drink it regularly, but made up for the deficiency apparently in the free consumption of hay and meal. The Shorthorn grade to which skim milk was fed, took more of this in quantity than the average grade consumed of whole milk, and also more of hay and roots, but a little less of meal. The native or scrub consumed considerably less than the average of all the food factors, except roots.

WEIGHTS. Table III gives an analysis of weights.

Grades.	Weights at end of—		Daily increase during—		
	First six months.	Second six months.	First six months.	Second six months.	First twelve months.
	℔.	℔.	℔.	℔.	℔.
Galloway	457	800	2.51	1.86	2.19
Shorthorn	530	890	2.91	1.96	2.44
Aberdeen Poll	485	754	2.66	1.46	2.07
Hereford	545	900	2.99	1.93	2.47
Devon	434	803	2.38	2.01	2.20
Holstein	537	883	2.95	1.86	2.42
Average (six breeds).	498	838.3	2.73	1.85	2.30
*Shorthorn	454	848	2.49	2.16	2.32
Scrub or native	386	700	2.12	1.76	1.92

*Fed on skim milk.

NOTE. In all the figures given in Table III the weight at birth is included. It was impossible to ascertain the birth weight owing to the way in which the calves were obtained.

It will be observed that at the close of the first period, the animal to which skim milk was fed was but forty-four lb. less than the average grade in weight, while he weighed sixty-eight lb. more than the native or scrub. At the end of one year he weighed 9.7 lb. more than the average grade, and 148 lb. more than the native or scrub. The latter weighed 112 lb less than the average grade at the end of the first period, and 138.3 lb. less at the end of the second period. It will also be observed that the lightest animal at the end of both periods is the native or scrub.

ESTIMATED VALUE OF THE FOOD. The fodder, the grain and the roots were estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions, (see Bulletin LXVIII, p. 5). The home value put upon the hay therefore, when cut, was $5.00 per ton; the green fodder $2.00 per ton; the oats 24½ cents per bushel; the peas 47 cents; the wheat screenings 30 cents, and the roots when sliced 8 cents. The grinding of the grain was put at six cents per 100 pounds. The bran and oil cake reckoned as delivered at the average Ontario farm were put at \$12.80 and \$26.66⅔ per ton respectively. The home value put upon the whole milk was 60 cents per 100 pounds. This conclusion was reached by valuing the milk delivered at an average Ontario factory at 70 cents per 100 pounds, and allowing 10 cents per 100 pounds for delivering the same. The price allowed for drawing the milk may be considered a shade high for some localities. The home value put upon the skim milk, the buttermilk reckoned at the same rate, was 15 cents per 100 pounds. This conclusion was reached by deducting the value of the butter, less the cost of making, from the home value of the whole milk. It was estimated that the average yield of butter from 100 pounds of whole milk in the farm dairy is 3¾ lb., that the cost of making is 3.9 cents per pound, and the average price obtained for it is 16 cents per pound. It will be observed that in all probability a profit has already been made on the marketable food used, providing it has been grown upon the farm, as in this experiment the food was charged at the full market values, less the cost of marketing from an average Ontario farm. This profit will be represented by the difference between the cost of growing and the market value put upon it.

VALUES. Table IV gives the financial results at the close of the milk period:

Grade.	Cost of—			Total Cost.	Value of—		Total value.	Gain + or Loss—
	Animal at birth.	Food.	Attendance.		Animals when six months old.	Manure.		
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
Galloway........	2 00	11 79	2 60	16 39	25 14	1 27	26 41	+10 02
Shorthorn.......	2 00	28 11	2 60	32 71	29 15	1 27	30 42	— 2 29
Aberdeen Poll...	2 00	26 89	2 60	31 49	26 68	1 27	27 95	— 3 54
Hereford	2 00	27 93	2 60	32 53	29 98	1 27	31 25	— 1 28
Devon	2 00	23 01	2 60	27 61	23 87	1 27	25 14	- 2 47
Holstein	2 00	28 66	2 60	33 26	25 51	1 27	26 78	— 6 48
Average (grade of six breeds).	2 00	24 40	2 60	29 00	26 72	1 27	27 99	— 1 01
*Shorthorn.......	2 00	9 06	2 60	13 66	21 57	1 27	22 84	+ 9 18
Scrub or native ..	1 00	23 58	2 60	27 18	14 48	1 27	15 75	—11 43

*Fed on skim milk.

No conclusions should be drawn from this table without carefully weighing all the facts contained in the bulletin.

The value put upon the animals at birth was of necessity an estimate that would be about the real value when they were dropped. The cost of attendance was reckoned on the basis that one man would feed and care for 75 calves per day under ordinary conditions, when the food has all been made ready.

The following was the valuation put upon the different animals in the experiment, viz.:—Galloway grade, 5½ cts. per pound live weight; Shorthorn grade, 5½ cts.; Aberdeen Poll grade, 5¼ cts.; Hereford grade, 5½ cts.; Holstein grade, 4¾ cts.; Shorthorn grade fed on skim milk, 4¾ cts., and native or scrub, 3¾ cts. This valuation was made at our request by Mr. James Millar and Mr. A. White, live stock dealers, Guelph. Notwithstanding that each of those gentlemen estimated separately, the respective valuations made by them were in substantial agreement.

The estimated amount of manure made per animal during the first period was 3,891½ lb. This was reckoned as worth $1.00 per ton. From the sum thus obtained the deduction was made of 903½ lb. of straw allowed for bedding, the home value of which was put at $1.50 per ton. This estimate was based upon actual results obtained from a test conducted simultaneously with another calf, and mainly with the object of ascertaining the amount of manure produced by a cattle beast during different stages of its growth.

The following facts stand out prominently at the close of this period, viz.:—1. The much greater cost of a whole milk ration with adjuncts, as compared with a skim milk ration with the same. With the first the average cost of the food was $24.40 per animal, and with the last $9.06, or nearly two-thirds less. 2. That although in the comparison just drawn there is a difference of $15.34 in the cost of the food, the difference in the value of the animals at the close of the periods is only $5.15. 3. The small amount of milk consumed by the Galloway grade after the first 53 days reduced the cost of the ration fed to him to $11.79, or $12 61 less than the average, and yet the difference in the average gains per day was not very marked. This would seem to indicate that a liberal whole milk ration is not an absolute necessity after the first two months of the life of the animal, and that the nature of the ration given affects the cost of production more than the particular improved breed with which the animal is connected. 4. The difference in the total value of the animal fed on skim milk, as compared with the average of those fed on whole milk, cost considered, is $10.19 in favor of the former and as compared with the native or scrub $20.61.

Table v gives the financial results at the end of one year.

Grades.	Cost of—			Total cost.	Value of—		Total value.	Gain+ or Loss.—
	Animal at birth.	Food.	Attendance.		Animals.	Manure.		
	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
Galloway	2 00	27 22	5 63	34 85	44 00	6 00	50 00	+15 15
Shorthorn	2 00	47 53	5 63	55 16	48 95	6 00	54 95	– 0 21
Aberdeen Poll...	2 00	43 02	5 63	50 65	39 59	6 00	45 59	– 5 06
Hereford	2 00	46 47	5 63	54 10	49 50	6 00	55 50	+ 1 40
Devon	2 00	41 62	5 63	49 25	44 17	6 00	50 17	+ 0 92
Holstein	2 00	48 53	5 63	56 16	41 94	6 00	47 94	– 8 22
Average (grades of six breeds).	2 00	42 40	5 63	50 03	44 69	6 00	50 69	+ 0 66
*Shorthorn	2 00	29 59	5 63	37 22	40 28	6 00	46 28	+ 9 06
Scrub or native .	1 00	39 61	5 63	46 24	27 13	6 00	33 13	–13 11

*Fed on skim milk.

No conclusions should be drawn from this table without carefully weighing all the facts contained in the bulletin.

During the second period the allowance for attendance is the same as in the previous one, with the difference, that one person is supposed to care for 60 animals instead of 75, as in the former period. The animals were valued at the same rate per pound live weight as at the close of the milk period. The amount of the manure made per animal was put at 9,996 lb. and it was reckoned at $1.25 per ton. From the sum thus obtained there was deducted 2,021$\frac{3}{4}$ lb. straw, valued as in the former instance. This estimate was also based upon actual results obtained as in the first reckoning of the manure.

It will be observed that the animal fed on skim milk cost $12.81 less than the average grade fed on whole milk, and $9.02 less than the native or scrub, whereas he gave a net gain of $9.72 in advance of the former, and of $22.17 in advance of the latter. While the native or scrub cost $3.79 less than the average grade, the net return given by him was also $17.56 less, that is to say, he cost $13.77 more than the former when one year old. He not only made the lowest gain per day, but was also rated the lowest by the valators.

CONCLUSIONS. The following are a few of the conclusions that may be drawn from the experiment:

1. That we should be slow to draw conclusions as to the relative value of the different improved breeds for making beef as the food and individuality of the animal exert so marked an influence.

2. That the behavior of the Galloway grade gives countenance to the idea that when a calf has been fed liberally by the dam for about two months, a milk ration is not indispensable after that period.

3. That the average grade of the different breeds in this experiment when well fed, will make a daily gain of 2.3 pounds during the first year, when the weight at birth is included.

4. That animals without improved blood are not capable of making gains so rapidly as those of good breeding, although fed with the same liberality.

5. That a young cattle beast fed on a skim milk ration with adjuncts, may be made to weigh almost as much when one year old as one of similar breeding fed on a whole milk ration with adjuncts similar in kind.

6. That the cost of making beef from young animals to which a whole milk ration has been fed, is much greater relatively than from those to which a skim milk ration has been given.

7. That while making beef from grade calves up to the age of one year is highly profitable when they are fed upon a skim milk ration followed by a heavy meal ration, that but little profit can be obtained when they are fed upon a whole milk ration followed by the same.

8. That some animals are more capable of producing beef of a higher quality than others.

9. That it is decidedly unprofitable to attempt to grow beef from native or scrub stock, even when the conditions are all favorable.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION.

BULLETIN LXXI.

EXPERIMENTS WITH SPRING GRAINS.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B.S.A., EXPERIMENTALIST.

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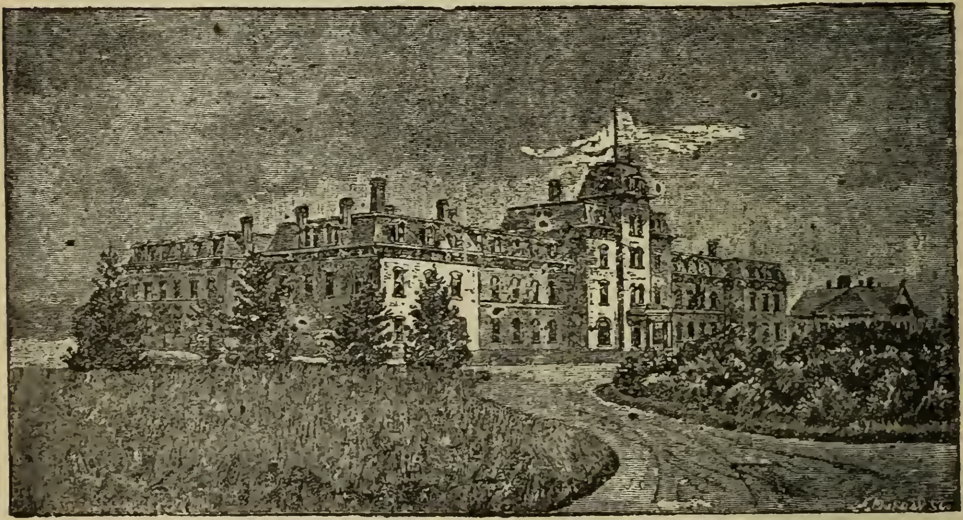

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BULLETIN LXXI.

EXPERIMENTS WITH SPRING GRAINS.

(140 varieties grown side by side for three years.)

The necessity for the introduction of new varieties of grain is apparent in the effort that is continually being made to obtain these by progressive farmers in all parts of the country. Where the capabilities of new grains have not been tested by growing them under similar circumstances for purposes of comparison, the farmers may, and without design on the part of anyone, be led to invest in varieties possessed of no superior merit. To meet this want and to prevent these mistakes much attention is being given by this station to the introduction and testing of new varieties from year to year.

This bulletin relates to spring grains, foreign and native, grown under similar conditions for the past three years, and it gives important comparisons with reference to them. These comparisons relate (1) to the yield of grain per acre, weight of grain per measured bushel, weight of straw per acre, and also to the date of maturing in 1891 of all the varieties mentioned; (2) to color of grain and other peculiarities of growth; and (3) to the conclusions of the flour and the oatmeal millers respectively as to the comparative value of the best varieties for milling purposes. Important particulars are also given in reference to results obtained from sowing various kinds of grain at different dates. Rust is not taken into account in the tables, as in 1891 all the varieties of grain grown were practically free from it. During 1891, 63 varieties of barley, 53 of spring wheat and 108 of oats were grown upon the farm. Full particulars relating to these will be found in the annual report. The information contained in this bulletin has been obtained from tests made with the varieties given below, viz.: barley 37 varieties, spring wheat 22 varieties and oats 81 varieties. These have been grown side by side for the past three years and under similar conditions. The plots varied from one-fiftieth to one one-hundredth of an acre in the different years. In the tables given below the yields of grain per acre are estimated from the standard bushels by weight, grown upon the plots.

Peas. 44 varieties of peas were sown in plots in 1891, but owing to imperfect germination of the seed of some of the varieties, we considered the conclusions too incomplete to be of any practical value.

Oats. The information given in Table I relates to the ten varieties of oats which have given the highest yields for the three years ending with 1891. The varieties grown in 1889 and 1890 were sown April 22nd, and those grown in 1891, April 29th.

Varieties.	Country whence obtained, 1889.	Color of grain.	Length of plant, 1891.	Date of maturity, 1891.	Weight per measured bushel, 1890-91.	Straw per acre, 1889-90-91.	Grain per acre (bu. 34 lb.), 1889 90-91.
			in.		lb.	tons	bush.
1 Joanette Black	France	Black	41	Aug. 11	35.7	2.7	85.2
2 Chenailles Black	France	Black	41	" 11	35.9	2.8	81.0
3 Black Etampes	France	Black	36	" 11	36.5	2.5	79.9
4 Houdan Black	France	Black	34	" 12	35.2	2.0	78.8
5 Siberian	Russia	White	49	" 7	37.8	2.5	77.8
6 Danebrog	Germany	White	48	" 19	34.1	2.4	77.3
7 White Canadian	Germany	White	48	" 19	34.0	2.7	77.1
8 Poland White	France	White	45	" 5	40.1	2.2	75.9
9 Improved Besthorn	Germany	Yellow	45	" 17	35.5	1.9	74.6
10 Egyptian	Ontario	White	49	" 17	38.0	2.9	74.4

It should be noticed that all of the leading varieties except the last mentioned, that is, the Egyptian, are foreign. They were imported for our Station from Europe in 1889. Of the 81 varieties grown during the three years mentioned, 15 only were from a Canadian source, and these included nearly all the old varieties. The Joanette Black, Chenailles Black, Black Etampes and Houdan Black are very much alike in all essential characteristics, so much so that the three first mentioned appear to be one and the same variety, though probably grown for some time past in different localities in France. The straw is strong and of medium height, or a little under medium. These varieties are therefore more suitable for sowing on good rich land. They stand up fairly well, are not coarse, and are almost entirely free from rust. They are also inclined to shell easily when ripe. Of the 27 newly obtained varieties of which we have the report but for one year, viz., for 1891, the Magnet stands first in point of yield. It gave 120.2 bush. per acre. The Golden Giant came second with a yield of 115.8 bush. per acre. The average of these newly introduced varieties for 1891 was 91.3 bush. per acre, and the average weight per measured bushel was 37 lb.

All the varieties of oats grown in 1891, viz., 108 kinds, were examined on November 18th by a deputation sent by the Oatmeal Millers' Association of the province. For milling purposes they pronounced the following varieties first-class without specifying any distinct order of merit, viz. : Bavarian, Magnet, Probsteier, Waterloo, Danebrog, Oderbrucker, Danist, Banner and Hopetown. The ten leading varieties in table have all the spreading head.

Spring Wheat. The information given in Table II relates to the ten varieties of spring wheat which have given the highest yields for the three years ending with 1891. The varieties grown in 1889 were sown April 18th, and those in 1890 and 1891 April 25th.

Varieties.	Country whence obtained, 1889.	Strength of straw, 1891.	Nature of head.	Length of plant.	Date of maturity 1891.	Weight per measured bush. '90-91	Straw per acre, 1890-91.	Grain per acre (bus. 60 lb.) 1889-90-91.
				ins.		lb.	ton.	bu.
1 Herison Bearded.	France ...	strong .	bearded	35.0	Aug. 11	64.6	1.55	26.6
2 Pringle'sChamp'n	Germany.	strong .	bearded	34.7	" 11	60.9	1.64	23.6
3 Summer	Germany.	medium	bearded	32.0	" 11	59.4	1.61	22.6
4 Holben's Impr'vd	Germany.	strong .	bald ...	31.2	" 13	59.5	1.60	21.9
5 Odessa Ghirka...	Russia ...	medium	bald ..	35.0	" 10	61.4	1.37	21.2
6 Konisburg.......	Russia ...	medium	bearded	33.0	" 10	62.3	1.56	20.6
7 Saxonka	Russia ...	medium	bald ...	39.5	" 11	60.0	1.08	20.2
8 Ordinary bearded March	France ..	strong .	bearded	34.0	" 11	58.4	1.52	20.1
9 Bart Treminia...	Greece ...	strong .	bearded	34.0	" 12	63.1	1.43	19.7
10 King Bartigen...	Germany.	medium	bearded	33.0	" 11	58.7	1.24	17.1

While the Herison Bearded comes first in point of yield, stands stiff in the straw and has been almost entirely free from rust, the club-shaped heads are somewhat uneven. The berry of this variety is a very fine sample. Pringle's Champion produces strong straw, has a good shaped head, is not much liable to rust, and produces a fine sample of grain. The McCarlin variety obtained from eastern Ontario, and grown for the first time at this Station in 1891, stands first in point of yield of the varieties introduced that year. The yield was 37 bus. per acre.

Samples of the 53 varieties of spring wheat grown upon the farm in 1891 were submitted to the Dominion Millers' Association at a largely attended meeting held in Toronto on Dec. 8th of that year. Nine varieties were pronounced by the committee as first class for milling purposes. They stand in the following order, viz.:—1. Red Fyfe, 2. Pringle's Champion, 3. Red Fern, 4. Rio Grand, 5. Herison Bearded, 6. Holben's Improved, 7. Odessa Ghirka, 8. Colorado, and 9. White Russian.

Barley. The information given in Table III. relates to the ten varieties of barley which gave the highest yields for the three years ending with 1891. The varieties grown in 1889 were sown on April

15th, those in 1890 on April 19th, and those in 1891 on April 30th.

Varieties.	Country whence obtained, 1889.	Number of rows in head.	Height of plant, 1891.	Strength of straw, 1891.	Date of maturity, 1891.	Weight per measured bushel, 1890-91.	Straw per acre, 1889-90-91.	Grain per acre (bush. 48 lb.), 1889-90-91.
			ins.			lb.	tons.	bush.
1 Mandscheuri	Russia ...	6	..	medium	Aug. 14	50.9	1.84	59.1
2 Chevalier........	France ...	2	31	strong .	" 14	52.6	1.79	54.8
3 Empress.........	England. .	2	35	strong .	" 19	52.2	2.05	54.1
4 Hallett's Pedigree	Germany .	2	31	medium	" 19	53.5	1.73	53.0
5 Oderbrucker.....	Germany .	6	34	strong .	July 31	53.7	1.49	52.5
6 Scotch Improved.	Ontario . .	6	33	strong .	Aug. 1	51.6	1.35	52.5
7 Improved Golden Melon...... .	England. .	2	38	weak...	" 18	52.2	1.82	51.1
8 Improved Cheyne	England. .	2	35	medium	" 15	52.5	1.98	50.3
9 Kalina...........	Sweden . .	2	36	medium	" 14	52.1	1.79	50.0
10 Imperial	France ...	2	36	medium	" 14	52.4	1.98	50.0
13 Ontario six-rowed	Ontario . .	6	33	medium	July 30	53.0	1.31	48.0

Carter's Prize Prolific comes 25th in order of yield. For the past three years it has given an average yield of 40.4 bush. per acre, and an average weight of 52¾ lb. per bush. The Mandscheuri, which stands at the head of the list, and the seed of which we imported from Russia in 1889, is probably the same variety as the Mensury. This variety also stands first in point of yield of the 63 kinds grown in 1891. It gave a return of 82.6 bushels per acre. The Highland Chief imported from Wisconsin and grown this year for the first time at this station, came second in point of yield. It is a two-rowed variety and weighed 52 lb. per bush.

The information given in Table IV relates to 6 varieties of hulless barley grown for the two years ending with 1891.

Varieties.	Country whence obtained.	Number of rows in head.	Height of plant, 1891.	Date of maturity, 1891.	Weight per measured bushel, 1890-91.	Straw per acre, 1890-91.	Grain per acre (bush. 48 lb.), 1890-91.	Grain per acre (bush. 60 lb.), 1890-91.
			in.		lb.	tons.	bush.	bush.
1 Hungarian	Hungary .	6	33	Aug. 11. .	61.5	1.69	60.0	48.0
2 Guymalaya	Sweden . .	6	36	" 14. .	59.9	1.97	50.6	40.5
3 Black Hulless ...	Ontario . .	6	32	" —. .	64.6	1.45	48.6	38.9
4 Large Skinned...	France ...	2	27	" 14. .	61.6	1.34	36.9	29.5
5 Three-rowed	Germany.	6	31	" 12. .	61.0	1.10	30.1	24.1
6 Skinless.	Australia.	6	24	" 1. .	60.7	1.00	27.6	22.1

It will be observed that as these kinds of barley weigh as heavily as spring wheat, 60 lb. has been taken as the standard weight per measured bushel. But for purposes of comparison with the other varieties the yield is also given in bush. of 48 lb. each. It is not improbable that some of these varieties may yet be found highly useful for feeding purposes.

Different Dates of Seeding. The details given in Table v relate to seeding barley, spring wheat and oats at different dates, in the spring of 1891. In every instance the figures used represent the average of two plots each sown with a different variety. But the same two varieties of each distinct kind of grain were sown throughout the period of experiment.

Date of seeding.	Barley.		Spring wheat.		Oats.	
	Weight per measured bushel.	Grain per acre (bu. 48 lb.)	Weight per measured bushel.	Grain per acre (bu. 60 lb.)	Weight per measured bushel.	Grain per acre (bu. 34 lb.)
	lb.	bu.	lb.	bu.	lb.	bu.
April 22nd	50.3	29.5	60.5	22.9	35.7	58.2
May 1st	48.6	37.8	59.0	19.1	36.2	69.0
May 9th	47.1	37.8	56.7	13.2	34.1	64.9
May 18th	45.5	24.8	54.2	8.0	32.4	49.7
May 26th	44.2	17.7	53.0	3.9	28.5	33.3
June 6th	42.4	17.4	51.5	3.2	24.9	23.4

It will be observed that the barley and oats sown upon April 22nd gave returns considerably less than those obtained from seed sown upon May 1st, but the spring wheat gave the best results from the earliest seeding. After May 1st the yield decreased in every instance but one with each successive seeding; the exception refers to the barley. It will also be observed that the weight of the grain per measured bushel decreased in every instance with each successive seeding, except in the case of the oats, where a slight increase is noticed in those sown on May 1st as compared with those sown on April 22nd. The dry weather of the earlier seedtime very probably exercised an influence on the returns obtained.

Remarks. It should be borne in mind (1) that the average yields obtained in growing these grains are more than the average is likely to prove in the country generally, for they were all grown under favorable conditions; (2) that similar weights are not likely to be realised unless the grains are thoroughly cleaned; and (3) that the facts in this bulletin will be valuable mainly in the localities with soil and climatic conditions similar to those here. The soil where these plots were grown may be termed a mild clay loam with a somewhat open subsoil. The field containing the plots grown in 1889 and 1890 was lowlying and that containing those grown in 1891 was elevated.

Conclusions. The following are some of the conclusions that may be drawn from the experiment:

1. That considerably higher yields may be expected from several of the foreign varieties of barley than from the Ontario six-rowed, where the soil and climate are similar to those at this station.

2. Owing to the substantial returns that may be obtained from some of the varieties of hulless barley, it may yet be found profitable to grow them more extensively for feeding purposes.

3. That higher yields may be expected from some of the foreign varieties of spring wheat than from those commonly grown heretofore, where the conditions of growth are similar to those at this station; and of all the foreign varieties as yet introduced here Pringle's Champion has been placed first for milling purposes.

4. That higher yields may be expected from several of the foreign varieties of oats than from the old varieties grown heretofore, where the conditions of growth are similar to those at this station, and that the highest yielding varieties have the spreading head.

5. That, speaking in general terms, barley, spring wheat and oats will yield well in proportion to the earliness of the date at which they are sown, but in the case of the two latter they may be sown in exceptional seasons at too early a date to obtain the very best results.

6. That, speaking in general terms, barley, spring wheat and oats are likely to weigh well in proportion to the earliness of the date at which they are sown.

7. That while the average yield of all the varieties sown May 1st was 42·0 bushels per acre, that from the same varieties sown 17 days later gave a yield of only 27·5 bushels per acre, and the greatest difference relatively was found in the case of spring wheat.

Distribution of Seed. Parties desirous of obtaining any varieties of spring grain in small lots for testing, will please apply for circular, which contains all necessary information in reference to this department of the work of our Station.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXII

ROOTS, POTATOES AND FODDER CORN.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B. S. A., EXPERIMENTALIST.

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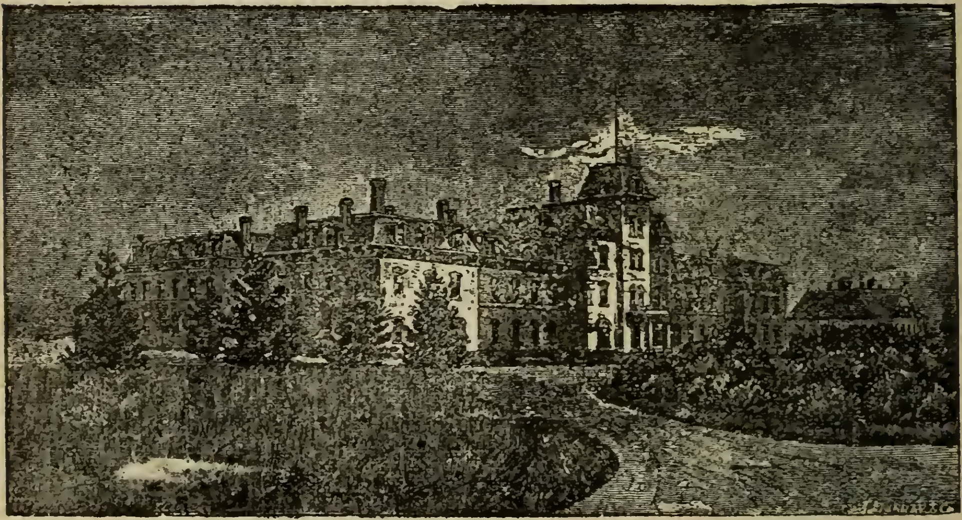

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BULLETIN LXXII.

ROOTS, POTATOES AND FODDER CORN.

Experience has taught our farmers that there is a tendency with all kinds of grain to deteriorate when grown for several years in the same locality, hence the necessity for the introduction of new varieties from time to time. The same holds true of field roots, potatoes and corn, hence the necessity will always exist for conducting experiments which will enable us to determine which of these varieties are worthy of the attention of the agriculturist.

The following include some of the principal objects of this bulletin, viz.:—(1) To give the comparative results obtained from growing leading varieties of roots, potatoes and fodder corn side by side, and under the same conditions, for one year, and in the case of some of them for a longer term; and (2) to give the comparative results from growing roots (*a*) upon ridges as against flat cultivation, and (*b*) upon rows at different distances apart.

In 1891, 57 varieties of turnips, 36 of mangels and 4 of sugar beets were grown at this station and upon plots side by side. Each plot consisted of two drills 6 rods in length. The soil was a clay loam of mild texture. It had produced grain crops for a number of years previously, was manured with a fair dressing of stable manure in the spring of 1890, and produced a crop of rape the same autumn which was pastured off on the land. The seeds of nearly all the varieties of roots tested were obtained from seedsmen in Ontario and the United States, but a few were also obtained from England.

Swede Turnips. 42 varieties were grown. The drills were 27.2 inches apart. In one drill the plants were thinned to a distance of 12 inches and in the other to 16 inches. They were sown June 19th. The following table gives the comparative results from the 6 varieties which gave the highest yields:

Varieties.	Description of roots.		Average weight per root of two seedings.	Average yield per acre.
	Shape.	Firmness of flesh.		
			lb.	tons.
Hartley's Bronze top.......	long ..	good	2.91	23.93
Marshall's Purple top	globe...	good	2.91	23.77
Sutton's Champion	globe...	medium..	2.95	23.54
Hazard's Swede turnip.....	long ..	good	2.91	23.12
Our selected Purple top	long ..	poor	2.89	22.95
Skirving's Swede	globe...	good	2.76	22.73

The following varieties have given the best yields for two years, viz.: Royal Norfolk Purple Top, 21.15 tons per acre, Hazard's Swede 20.92, and Carter's Elephant 19.87 tons. The average yield of all the Swedish varieties grown in 1891 was 19.7 tons.

White Fleshed and Yellow Fleshed Turnips. 15 varieties were grown. The drills were 27.2 inches apart. In one drill the plants were thinned to 16 inches and in the other to 13 inches in the row. They were sown June 19th. These varieties are all white fleshed. The comparative results from the six varieties which gave the highest yields are shown below.

Varieties.	Shape of roots.	Average weight per root of two seedings.	Average yield per acre.
		lb.	tons.
Grey Stone Improved		4.29	29.28
Red Globe Norfolk	globe	3.67	28.69
Jersey Navet	"	3.74	28.23
Grey Stone	"	3.56	28.08
Purple Top Main	slightly flat	3.48	26.09
Red Top Strap Leaf	flat.	3.15	25.97

The following varieties have given the best yields for two years, viz: Red Globe Norfolk, 27.6 tons per acre, Red Top Strap Leaf, 23.3 tons, and Pomeranian White Globe, 22 tons. These also are all white fleshed varieties. The 11 white fleshed varieties averaged 25.6 tons per acre, and the four yellow fleshed 20.22 tons.

Mangels. 36 varieties were grown. The drills were 22½ inches apart. In one drill the plants were thinned to 7 inches and in the other to 14 inches. They were sown May 23rd. The next table gives the comparative results from the six varieties which gave the highest yields.

Varieties.	Shape.	Uniformity.	Average weight per root of two seedings.	Average yield per acre.
			lb.	tons.
Improved Mammoth Prize, long red	long	even	2.55	35.56
Carter's Champion	half long.	"	2.77	34.09
Mammoth Sawlog	long	"	2.68	34.00
Steele Bros. Long Red Selected	"	medium	2.61	33.33
Norbitan Giant	"	"	2.59	32.07
Eiffel Tower	half long.	"	2.46	32.04

It will be observed that these do not comprise any of the globe varieties. The highest yielding globe variety came 18th in the list. The 14 distinctively long varieties yielded an average of 28.57 tons per acre and the six globe varieties an average of 22.42 tons. The following varieties have given the best yields per acre for two years, viz: Norbitan Giant 22.9 tons, Long Red 19.3 tons and Carter's Warden Orange 18.3 tons.

Sugar Beets. 4 varieties were grown. The drills were 22½ inches apart. In one drill the plants were thinned to 6 inches in the row, and in the other to 12 inches. They were sown May 23rd.

Varieties.	Average weight per root.	Yield per acre.
	lb.	tons.
Vilmorin's Improved White..	2.02	21.30
German White	1.64	20.71
Silesian	1.53	20.59
French White	1.42	16.87

It will be observed that the German White, the kind which has been grown most extensively over the province, comes second on the list in point of yield. The average yield of the four varieties is 19.86 tons per acre.

Potatoes. 74 varieties were grown in 1891, and 25 varieties for the two years past. The seed was obtained from the United States, the maritime provinces and Ontario. The soil was a clay loam containing a large amount of vegetable matter. It lay in sod for five years, was turned over last autumn and was thoroughly cultivated in the spring. One peck of the tubers of each variety was cut into 180 sets and planted in drills 28¼ inches apart. The rows were 181½ ft. long.

Results from the six varieties which gave the highest yields:

Varieties.	Maturity. 1891.	Uniformity of tubers. 1891.	Average yield per acre. 1890-91.
			bush.
Empire State	medium	good	192.9
Summit....	late	good	147.3
Early Maine..............	early.	medium	140.9
Clark No. 1	medium	good	138.0
Pootaluck	medium	good	130.3
Thorburn	medium	good	129.2

By actual test we have found all these varieties to possess good edible qualities with the exception of the Pootaluck, which probably should not be classed higher than medium.

Fodder Corn. 84 varieties were grown in 1891. The seed was obtained chiefly from the northern States, but some of it came from the southern States and some was obtained from Ontario. All these varieties were grown in duplicate in the first instance upon sod which had not been plowed for six years, and in the second on land which had grown different kinds of grain for four years previously. The sod was turned under in the autumn of 1890. No manure was applied nor had it received any since 1886. The stubble land was also plowed the previous autumn, and had received a fair application of farmyard manure in the spring of 1890. The soil was a mild clay loam and rather low lying. The corn was planted in hills, 5 links or 39.6 inches apart each way. But one row of each variety was planted on each kind of soil. The rows were 165 ft. long on the sod, and 99 ft. long on the stubble ground. But four plants were left in each hill. Thorough shallow cultivation was given the rows both ways. Following are the results:

Varieties.	Class of corn.	Maturity.	Weight of green ears per acre, 1891.	Average yield per acre of the whole crop, 1889-90-91.
			lb.	tons.
Sheep's Tooth	White dent ..	Late	1,966	16.62
Chester County Mammoth..	Yellow dent .	Late	1,800	16.41
Calico Dent	Mixed dent ..	Medium......	4,333	15.25
Leaming Dent..............	Yellow dent .	Medium late..	3,866	15.23
Cranberry White Dent......	White dent ..	Late	900	15.10
Compton's Early	Yellow flint..	Early	6,000	15.03
Wisconsin Yellow Dent	Yellow dent .	Medium late..	3,166	14.94
Mammoth Southern Sweet..	White dent ..	Late	1,060	14.86
South Western	White dent ..	Late	1,700	14.62
Wisconsin White Flint	White flint...	Medium......	5,735	14.55

It should be remembered that these varieties were grown for fodder purposes whether in the green or dried state or cured in the silo. Eight of the ten varieties were dent and two were flint. It has been found somewhat difficult hitherto to get flint varieties which produce sufficient weights per acre, but this experiment shows that the two flint varieties named in the table weigh well and also produce a large quantity of grain. Of the other varieties the most suitable probably for the silo in temperatures the same as at this station are Compton's Early, Wisconsin White Flint, Leaming Yellow, and Wisconsin Yellow Dent.

The next table gives the comparative results obtained from growing Swede turnips, mangels, and sugar beets upon ridged drills as against flat cultivation. Each result mentioned in the table is the average of triplicate tests.

Modes of cultivation.	Average yield per acre (tons).		
	Swede turnips.	Mangels.	Sugar beets.
Flat cultivation	26.06	21.55	13.02
Ridged cultivation	25.83	19.52	12.91

It will be observed that the largest yield in each instance was obtained from the roots grown upon the level surface, and it is most marked in the case of the mangels.

The next table shows the comparative average yields per acre of Swede turnips, mangels and sugar beets grown in rows, 16, 24 and 28 inches apart. The turnips were thinned to the distance of 14 inches in the rows, the mangels 14 inches, and the sugar beets 7 inches. The mangels and sugar beets were sown on May 20th, and the turnips on June 22nd.

Distance between rows.	Average yield per acre (tons).		
	Swede turnips.	Mangels.	Sugar beets.
16 inches..................	27.39	24.05	14.03
24 inches..................	26.66	21.15	13.36
28 inches..................	23.78	16.42	11.51

It will be observed that those with the shortest distances between them gave the highest yields in every instance, but further tests will be required before conclusions can be drawn which can be followed with safety.

Conclusions.

The following conclusions may be safely drawn from the different experiments summarised in the Bulletin :

1. That while the average yield of the 11 varieties of white-fleshed turnips per acre was 853 bushels, that of the 4 yellow-fleshed varieties was but 673.3 bushels.

2. That while the average yield of the 14 distinctively long varieties of mangels was 952 bushels per acre, that of the 6 globe varieties was but 747 bushels.

3. That the best yielding varieties of potatoes tested at this station for the past two years are also possessed of good edible qualities.

4. That for quantity and quality of fodder and earliness in maturing the Compton's Early, Wisconsin White Flint, Leaming Yellow and Wisconsin Yellow Dent are probably the most suitable for the silo among the 35 varieties tested here for the past three years.

5. That in this test the mangels grown on the level gave 10.4 per cent. more of an increase than when grown on ridges, while the difference with the turnips and sugar beets was but slight.

Distribution of Seed. Parties desirous of obtaining seed of any of the leading varieties of field roots and corn grown at this station, for purposes of testing, should apply for circular, which contains all necessary information in reference to this department of the work of our Station.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION.

BULLETIN LXXIII.

FUNGICIDES AND INSECTICIDES.

BY J. H. PANTON, M.A., PROFESSOR OF NATURAL
HISTORY AND GEOLOGY.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE

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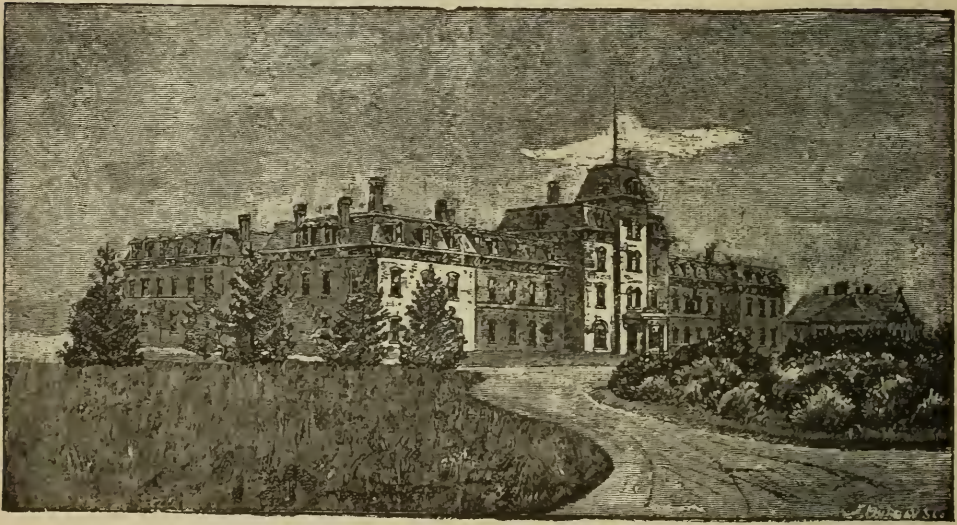

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BULLETIN LXXIII.

FUNGICIDES AND INSECTICIDES.

Of the numerous experiments that are being carried on at Experiment Stations in Canada and the United States none have afforded more definite results than those conducted for the purpose of ascertaining what compounds may be used successfully against such parasitic plants as blights, mildews, rusts and smuts, and against the insects injurious to vegetation.

Although results of these investigations are printed in agricultural and horticultural journals from time to time, yet many Canadian farmers are not fully informed in regard to them. During a late trip in connection with Farmers' Institutes I was surprised that so few had as yet learned anything from this field of investigation. With a view to reach at least the members of Institutes in Ontario I have put into this Bulletin some practical knowledge upon the results of researches in reference to the use of fungicides and insecticides, and hope it will prove handy for reference when information regarding these is required.

I. FUNGICIDES.

Fungicides may be defined as chemical compounds or mixtures used for the purpose of destroying such injurious forms of plant life as live upon other plants by absorbing their juices to such an extent as to affect their vitality. Examples are seen in the *rusts, smuts, mildews and blights.*

It is but a comparatively short time since the life history of these obscure forms of plant life has been made out; but during late years wonderful strides have been made in this department of biology, and we are now in possession of knowledge that enables us to hold in check their destructive effects by the application of so-called fungicides; among which some of the most important are:

Bordeaux Mixture. This consists of copper sulphate, lime and water in the following proportions: 6 lb. copper sulphate, 4 lb. lime, 22 gals. water. This may be prepared by dissolving the copper compound in 16 gals. water; slake the lime in 6 gals. water, and when the latter is cooled pour it slowly into the copper solution and mix thoroughly. Some use less water for dissolving the first. This solution sprayed has been successful against downy mildew of the grape and potato blight.

A modified form 4 lb. copper sulphate, 4 lb. lime and 50 gals. water has been beneficial upon raspberries affected with Anthracnose.

Eau Celeste. This consists of copper sulphate, ammonia (commercial) and water, 1 lb. copper sulphate, 1½ pints ammonia and 22 gals. water. Dissolve the copper sulphate in about 2 gals. hot water, as soon as cool add the 1½ pints ammonia and dilute to 22 gals.

A modified form has given better results, viz.: 2 lb. copper sulphate dissolved in two gals. water, 2½ lb. sodium carbonate (washing soda) dissolved in another vessel. Mix these, and when chemical action has ceased add 1½ pints of ammonia and dilute to 22 gals. Some dilute even to 30 with good results.

This has been found good against downy mildew of grapes, black rot of grape, anthracnose, blight of potato, rot of the tomato, gooseberry mildew and scab of apple when sprayed upon the affected plants.

Eau Grison (Grison Liquid). This consists of sulphur, lime and water. Boil 3 lb. sulphur and 3 lb. lime in 6 gals. water until reduced to 2 gals. When settled pour off the clear liquid; this may be bottled and when used dilute with 100 parts water. This is used to destroy downy mildew and powdery mildew of the grape and the mildew of the gooseberry.

Copper Sulphate. 1 lb. in 24 gals. water used to destroy smut on seed grain. Soak the seed in this for from 12 to 16 hours; then dip it into lime water for five minutes. The last step is not absolutely necessary, but is an improvement.

**Ammoniacal solution of copper carbonate.* Copper carbonate, ammonia and water. Dissolve 3 oz. copper carbonate in 1 quart ammonia, and when about to use dilute to 22 gals. Some use more water (28 gals.) Used to destroy grape mildew and apple scab. In the latter disease it has been very successful.

Potassium Sulphide. 1 oz. potassium sulphide to 2 gals. water destroys gooseberry mildew and strawberry blight—so-called "Sunburn."

Sodium Hyposulphite. 1 lb. to 10 gals. water used against apple scab, but not so successful as Eau Celeste and the ammoniacal solution of copper carbonate.

II. INSECTICIDES.

Compounds or mixtures used to destroy insects injurious to vegetation.

Paris Green (arsenite of copper containing 50 to 60 per cent. of arsenic). Applied dry or in solution. In the dry form best mixed with 50 to 100 parts plaster, wood-ashes, flour or air-slacked lime and dusted upon the affected plants. The wet form is usually used in the proportion of 1 lb. Paris green to 200 gals. of water, but if the foliage is tender 250 to 300 gals. water (applies to application upon the plum. As this green powder does not dissolve it requires to be kept thoroughly mixed. It is an excellent insecticide against potato bug, plum curculio, canker worm, tent-caterpillar grape vine beetle and codling moth. It can be used successfully in nearly all cases of leaf-eating insects.

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*In spraying, to prevent downy mildew of the grape spray ten days before blossoms appear, again as soon as berries are well set, and two or three applications afterwards at intervals of about ten days if needed. To prevent apple scab, spray before blossoms open and also after they have fallen, and if deemed necessary twice at an interval of about ten days.

London Purple. An arsenite of lime obtained as a by-product in manufacturing dyes; is largely used instead of Paris green; but being more soluble in water it is likely to injure the foliage, and besides its composition varies considerably so that when used it is not likely to give as uniform results as Paris green.

In spraying for codling moth it is usual to spray after the blossoms fall, when the apples are about the size of peas and before they have turned downwards on the stem, and a second time about ten days after. For plum curculio, as soon as the fruit is formed, followed by two or three applications with an interval of ten days between. In this case the solution is weaker than that used upon the apple, 1 lb. in 250 to 300 gals. of water.

Kerosene Emulsion. A mixture of coal oil and water. There are three mixtures of this kind that are used to a considerable extent:

(*a*) Riley-Hubbard Emulsion. ½ lb. hard soap in 1 gal. rain water, boil till dissolved, then add 2 gals. coal oil and mix thoroughly for about five minutes. When properly mixed it will adhere to glass without oiliness. In using dilute with 9 parts water (soft).

(*b*) Cook's Emulsion (soft soap). 1 quart soft soap, 2 quarts boiling water. While hot add 1 pint of coal oil. Mix thoroughly. In using dilute with equal amount of water.

(*c*) Cook's Emulsion (hard soap). ¼ lb hard soap, 2 quarts water and 1 pint coal oil, and thoroughly mix while hot. In using dilute with twice the amount of water.

These emulsions are very excellent against plant lice, scale insects, chinch bug, cabbage-worm and even rose-beetle.

Hellebore. Obtained from the powdered roots of a plant (Veratrum album. May be applied dry or as liquid. 1 oz. to 3 gals. water. Excellent against currant worm and cherry slug.

Pyrethrum. Made from the powdered flowers of the genus pyrethrum, a plant of the sunflower family. It should be fresh, and hence should be kept in closed vessels. Used in dry form, 1 part pyrethrum, 5 to 8 parts flour; or liquid 1 oz. in 3 gals. water. A good remedy for cabbage worm.

Carbolic Acid Emulsion. 1 part carbolic acid tc 5 to 7 parts of a solution consisting of 1 quart soft soap or 1 lb. hard in 2 gals. water. This applied to affected trees destroys bark lice and the borers. It should be well rubbed upon the parts attacked.

Carbolized Plaster. A mixture of carbolic acid and land plaster, 1 pint of the former and 50 lb. of the latter. A remedy against flea beetles.

Tobacco. The refuse from cigar manufactories answers the purpose. A strong solution added to one gallon water destroys plant lice and flea beetles.

Alkaline Wash. A strong solution of washing soda mixed with soft soap until about as thick as paint. Applied to the trunk of trees destroys the borers and gives a healthy vigorous tone to the tree.

III. APPLICATION OF FUNGICIDES AND INSECTICIDES.

The foregoing compounds and mixtures are usually applied by means of spraying machines, many of which are now advertised, and information concerning them be readily obtained from seedsmen or others concerned in their sale. As such are readily accessible to farmers and gardeners it is unnecessary to give the names of manufactures in this Bulletin.

The following list of prices will give the readers an idea of the approximate cost incurred by the use of certain compounds in making up mixtures. Price per lb.:

Ammonia, 25c.; copper carbonate, 60c.; Paris green, 30c.; London purple, 15c ; pyrethrum, 40c.; copper sulphate, 12c.; hellebore, 25c.; sodium carbonate, 5c.

PRECAUTIONS IN SPRAYING, ETC.

1. Keep poisonous substances labelled and out of the way of children.
2. Do not continue to spray so far into the season as to affect the fruit.
3. In making emulsions remember the inflammable nature of coal oil.
4. Never spray trees in bloom.
5. Try mixtures on a small scale if you have any doubts regarding their effect upon the foliage.
6. Be careful and thorough in your work.

Much has been said of late regarding the danger incurred by eating fruit from trees and vines which had been sprayed with Paris green ; but careful chemical analysis show there is no ground for such an alarm. In the case of some suspected apples it was found that eight tons would require to be eaten before a dose of poison would be taken.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXIV.

RAPE CULTURE

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B. S. A., EXPERIMENTALIST.

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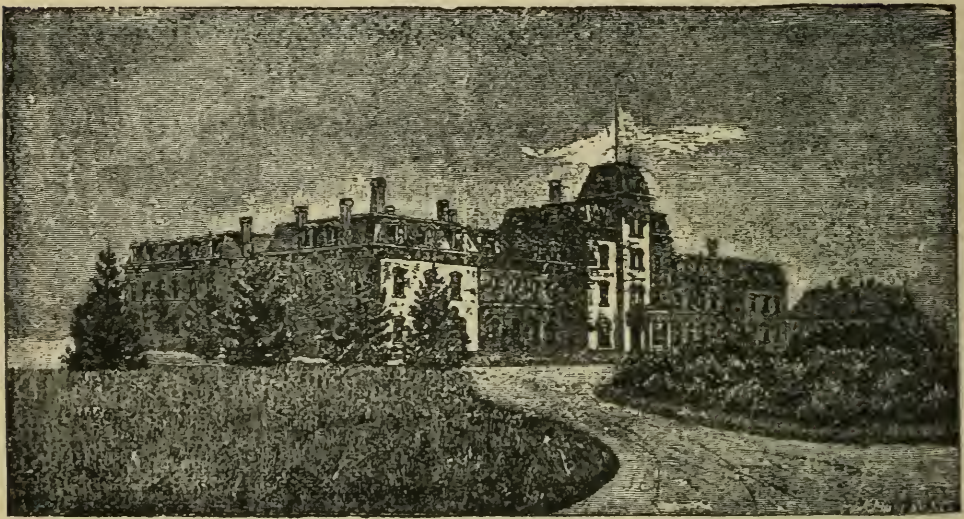

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BULLETIN LXXIV

RAPE CULTURE

The principal objects of this Bulletin are: 1. To call the attention of the farmers to the value of the rape crop to the agriculture of Canada. 2. To make known to them the various uses to which it may be put, viewed from the standpoint of our experience with it at this station. 3. To speak of the best modes of growing it under our conditions of soil and climate, so far as we have been able to ascertain these up to the present time. Since Bulletin LX was issued we have gained not a little information in reference to the growth of this plant, the uses to which it may be put and the modes of feeding it; the information thus gleaned is made prominent in the Bulletin.

Description of Rape. As many persons do not know what rape is, a brief description of the plant may be necessary. It bears a close resemblance to the Swede turnip in the early stages of its growth, but it usually attains a greater height than the turnip and produces more of stem and leaves. It has a fusiform and stringy root while that of the turnip is bulbous. On average soils, when grown in drills it usually reaches the height of from one to two feet, but on soils very rich in vegetable matter it sometimes attains the height of at least three feet. There are several varieties of rape, but the only kind grown as a pasture in this country is known as the Dwarf Essex.

Adaptability to Climate. Like the turnip rape is adapted to temperate climates. In all probability it will be found to grow in temperatures that are inclined to be cool rather than warm. It seems to grow more vigorously in our climate in the late rather than the early summer, and it continues to grow until the time of severe frosts when not matured at an earlier period. It is scarcely probable that rape will live through the winter in this latitude and yet retain sufficient vigor to produce a crop of seed the following summer as in Great Britain. In our experience much of it has perished from the intensity of the frosts.

Adaptability of Soils. The most suitable soils for growing rape are fairly moist, free-working loams, rich in organic matter. Black loams are very suitable after the plants once get a start in them owing to the large amount of humus which they contain. Muck swamps when drained yield magnificent crops, and the rape grown upon them tends to reduce the excess of organic matter which they contain. Soils that are suitable for growing good crops of turnips and corn will also be found well adapted in most instances to the growing of rape. It will not grow well on stiff clays, poor sands or on any kind of soil deficient in plant food.

PLACE IN THE ROTATION. As rape is an excellent cleaning crop when grown in drills and cultivated, it may with much advantage be placed between two crops of grain. As it luxuriates in soils abounding in vegetable matter it may be grown with much success on an overturned sod, inverted in the autumn or in the spring, or just after cutting the first crop of clover. We have obtained excellent results after sod overturned in August and sown with rye, cut green, and then followed by rape.

PREPARATION OF THE SOIL. The preparation of the soil will to some extent depend upon the rotation. When rape is the only crop grown and the land is not foul, thorough spring cultivation will be found sufficient. When the land requires cleaning autumn cultivation followed by frequent stirring of the soil in the spring will be found effective in reducing weed life and in securing that fineness of tilth and retention of moisture so helpful in the growth of rape. A favorite method with us is to sow a crop of rye in September, to cut it when well out in head with the binder for winter fodder, or when in the blossom, to be made into silage. But it would also serve a good purpose to sow the rye in August and pasture fall and spring until the first of June. After the rye in either case the land is at once prepared for rape. The preparation consists in plowing carefully, rolling as soon as plowed, harrowing once a week and making the land into drills from 22 to 24 inches apart just before sowing the rape. When rape is grown as a catch-crop it may be sown broadcast or in drills after the removal of the previous crop. When sown broadcast the ground may be turned over with the gang-plow, but when grown in drills and cultivated the ordinary plow should be used.

FERTILISERS FOR RAPE. Although rape in an average season will give a fair return from ordinary land, it is unusually responsive to large applications of farmyard manure. In average soils therefore it is more than probable that the application of a complete fertiliser will give good results, but in our experience the largest increase of crop has been obtained from the application of nitrate of soda and the next largest from the application of salt.

SEED AND SOWING. The most suitable time for sowing rape in nearly all parts of Ontario is from June 25th to July 5th, although a fair crop may be obtained when it is sown earlier, and a full crop may sometimes be grown as late as the end of July. For catch-crops it should be sown as soon as possible after the previous crop has been removed.

The mode of sowing and the amount of seed used will depend upon the object sought. When the ground does not require cleaning and also on muck swamps and humus soils generally it may be sown broadcast at the rate of 3 to 5 pounds of seed per acre. When sown as a catch crop or for green manure similar amounts will suffice, and the mode of sowing is the same. When sown in drills from 1 to 2 pounds of seed may be used, according to the condition of the ground. The seed is ordinarily sown with a turnip drill which puts in two rows at a time. It may be obtained from any of our leading seedsmen and usually at a cost not exceeding 10 cents per pound.

CULTIVATION. When the rough leaf has made a good start in the rape the cultivator may be introduced. It should run as close to the line of the rows as is consistent with the safety of the plants, and the cultivation should be frequent until the tops of the rape have made a near approach between the rows.

When the land is fairly clean no hand-hoeing is required, but when it is foul it will be necessary to go along the line of the drill with the hand-hoe once or twice to remove weeds which need not of necessity cost more than $1 per acre. No attention is given ordinarily to thinning rape.

OUR EXPERIENCE WITH RAPE. In 1889 we grew 12 acres of rape at this station for pasture. In 1890 some 54 acres were grown for the same purpose and in 1891 about 40 acres. 10 acres were grown as a catch crop in 1890, and 6 acres in 1891. A large number of plots were also grown each year by way of experiment.

The following are the chief of these experiments : (1) Rape grown on four kinds of soil with and without salt ; (2) Rape grown in drills as against flat cultivation ; (3) Rape grown in drills as against broadcast seeding ; (4) Rape grown in drills at different distances apart ; (5) Using different quantities of seed per acre ; (6) Thinning the plants to different distances in the drills ; (7) Applying different fertilisers to ascertain their respective values ; (8) Feeding lambs upon rape grown after fall wheat ; (9) Testing the amount of pasture furnished by a single crop of rape grown under favorable conditions ; (10) Pasturing lambs upon rape alone, rape with a supplement of oats and rape with access to a grass pasture ; (11) Pasturing swine upon rape alone ; (12) Feeding rape as a soiling crop.

The results of these experiments we hope to give in summarised detail at some future time. In the meantime we may mention that in our experience flat cultivation in drills has given somewhat larger returns than ridge cultivation ; that larger crops can be obtained from rape grown in drills than broadcast ; that salt and nitrate of soda are serviceable as fertilisers for rape ; that oats do not seem to render much service when fed along with rape that is being pastured by lambs, and that rape and old meadow pasture are superior to rape alone as a pasture for lambs.

THE USES OF RAPE. Rape is valuable as a pasture; as a catch crop; as a green manure, and as a cleaning crop.

1. Rape as a *pasture.* Rape is an excellent pasture for sheep and lambs and for cattle that are being fattened, and so far as we can judge from our limited experience, it will also furnish good pasture for swine. The nutritive ratio of green rape as given by Wolf is 1:2.9, while that of red clover in blossom is only 1:5.7. All things considered the value of rape for fattening is from two to three times greater than that of one cutting of a crop of clover of a similar area.

In 1889 we pastured 48 lambs on rape; in 1890, 537 head, and in 1891, 666 head. A number of these in each instance were carried on into the winter after the season for pasturing was over, and it was found that they fed well when taken off the rape and put into winter quarters.

In our experience of three years in growing rape we find that one acre will pasture on an average 10 to 16 lambs from 2 to 2½ months when rye grown for fodder, has preceded the rape the same season. When grown on ground that had not been cropped previously the same season, all the conditions being favorable, we found that one acre of rape would pasture 36 to 37 head of lambs for 2 months, and that it increased the live weight of the lambs 762 pounds, which at 5 cents per pound would put the food value of the rape at $38.10 per acre. In our experience the lowest average gain made per month by any considerable number of lambs pasturing upon rape alone was 7.80 pounds, and the highest 12.60 pounds.

In 1890 the average price paid for 48 lambs when bought October 9th was $3.85 per head. They were sold the following March for the Halifax market at $7.71 per head. In 1890 the average price paid for 537 lambs when delivered at this station in September and October was $3.76 per head. The average price received for 364 head shipped to Buffalo on December 19th was $5.54. The following May 100 head shipped to Liverpool sold in that market at $11.79 per head. A limited number of choice ones were selected and fed on through the summer. Two of these were taken to the American Fat Stock Show at Chicago and won first and second prizes respectively in their classes in continental competition.

Last year 666 head were purchased in Prince Edward Island, eastern Ontario and Toronto. The average price paid was $3.15 when laid down at our station. The average price for which they were sold in the months of January, February, March, April and May was $5.73. They went to the markets of Ontario, the United States and England. The profits on the lambs bought in 1889 and 1890 were highly satisfactory as may be gleaned from the reports already published concerning them. The same is also true of those purchased in

1891 as will be shown in the bulletin to come after this one, although they were considerably below the average of Canadian lambs in quality and breeding.

2. Rape as a *catch* crop. The extent to which rape may be grown as a catch crop is only limited by the desires of the farmer and the nature of the season as to the presence or absence of moisture. It may follow any grain crop that has been reaped early and that has been sown with grasses or clovers. In 1891 we grew rape in drills on 2.18 acres of land which had already produced an extraordinary crop of wheat. 60 lambs were pastured on the rape grown upon it for 25 days without any additional food. The aggregate increase in live weight was at the rate of 179 pounds per acre, which at 5 cents per pound gives $8.95 as the food value of the rape without considering the increase in value of the original weight of carcase.

3. Rape as a *soiling* crop. Our experience with rape as a soiling crop is somewhat limited, but we have found that when it is cut before the snow falls and put up in heaps of some size in the field it will keep for several weeks. It may then be drawn from these heaps when wanted and fed to animals indoors. Although milch cows cannot be pastured upon rape owing to the taint which it would give the milk we have good reasons for believing that if it is carried and fed to the cows after each milking the results will be satisfactory.

4. Rape as a *green manure.* Although our experience in growing rape as a green manure is limited, there need be no doubt as to its pre-eminent adaptability for that purpose especially when grown as a catch crop. The roots permeate the soil and the plants when not matured will continue to grow until the time of hard frost.

5. Rape as a *cleaning* crop. As a cleaning crop we have found none that will compare with rape in all round effectiveness. On soils suitable to its growth almost any of the more noxious forms of weed life can be eradicated in a single season, with wise management, except in so far as the seeds of the same remain in the ground without germination.

PRECAUTIONS TO BE OBSERVED IN GROWING RAPE. Cattle and sheep should never be turned upon rape when hungry lest they eat too freely of it. When sheep are put upon it they may be left there, but when they have free access to a pasture they will probably do better. They should have salt at will but usually do not require grain. On very frosty mornings, they should be kept off the rape for a time. The owners of pure-bred stock should use much care when pasturing valuable animals on rape.

CONCLUSIONS.

1. That in nearly all the cultivable portions of the Dominion the climatic conditions will be found suitable to the growing of rape.

2. That a large proportion of the soil of Ontario is well adapted to the growth of rape.

3. That rape is specially valuable as a pasture for fattening sheep and lambs owing to the season of the year at which it grows, and to its high feeding value.

4. That it is an excellent food when preparing lambs for winter fattening.

5. That one acre of rape grown in drills immediately after a crop of rye cut as a green food will pasture from 10 to 16 lambs for from 2 to 2½ months, and that when grown as the sole crop of the season under favorable conditions it will sustain a much larger number.

6. That ordinary grade lambs when pastured on rape without any other food supplement will make an average gain of 10 pounds per month.

7. That rape is admirably adapted for growing as a catch crop to be fed off or plowed under as a green manure.

8. That rape as a cleaning crop is probably without a rival in our present system of agriculture.

9. That much care and prudence must be exercised in pasturing animals on rape or serious losses may follow.

10. That rape is not an exhaustive crop on the soil when pastured off, as what has been taken from the cultivable area is returned to it and something in addition.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXV.

BUTTER-MAKING ON THE FARM IN SUMMER.

BULLETIN LXXVI.

BUTTER-FAT IN MILK AND CREAM.

BY H. H. DEAN, B.S.A., PROFESSOR OF DAIRY HUSBANDRY.

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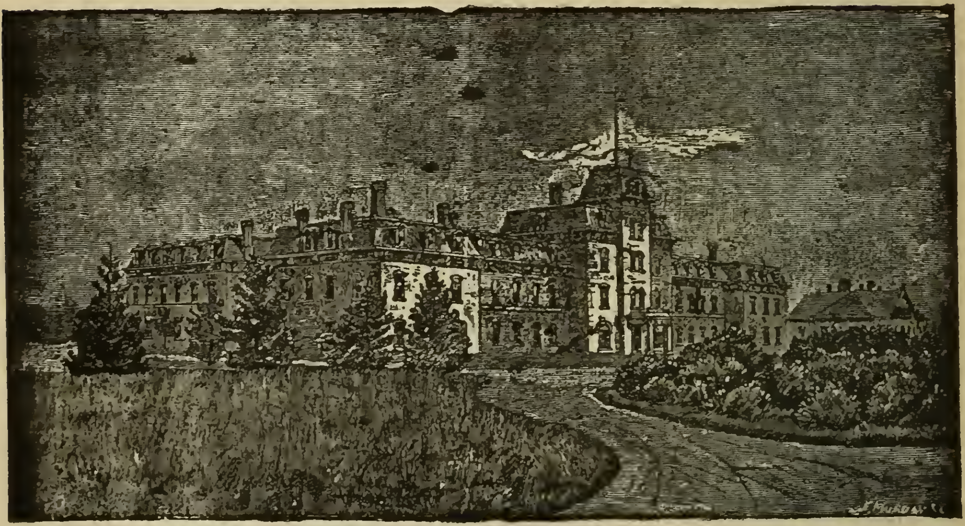

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BULLETIN LXXV.

BUTTER-MAKING ON THE FARM IN SUMMER.

Many enquiries have recently been received by this department as to printed matter dealing with butter-making, which shows that there is a desire for something of that nature. To aid the overworked farmers' wives and daughters in the difficulties which constantly arise in the handling and care of milk and cream, and also in the churning of the butter, we thought that we could not do better than to give a simple outline of how our dairy at Guelph is managed in the summer time. We might here say, however, that we think it would be far better for our butter-making industry if the manufacture of the butter were done more largely in creameries or factories as in the case of cheese. The chief advantages of such a system are, a more uniformly good quality of produce and a lessening of labor at the farm.

Our dairy herd at the present time numbers fourteen cows, twelve of which are now giving milk. We are raising eight calves, which are fed chiefly on warm sweet skim-milk containing a little oil cake. Each calf has a small box in which dry oatmeal and oil cake are placed, and which they soon learn to eat with a relish. Some cut grass fed in the stable completes their ration.

IN THE STABLE. At present the cows are at pasture. Night and morning they are brought into the stable to be milked, and are fed a small quantity of bran—about one pound a day. At the side of each manger is a small box, which is kept full of salt, and in front of each animal is a water trough, where they may obtain drink at will. Before commencing to milk the *men* wash their hands, for which purpose we keep a wash basin, soap and towel in the stable. Milking begins at five o'clock morning and evening. Each cow's udder is well brushed before commencing to milk, and the milking is done as quickly and quietly as possible. As soon as the cow is milked her milk is weighed, and the weight recorded on a sheet. (Twice a week, morning and evening, each cow's milk is tested for the per cent. of fat or butter in her milk.) The milk is then strained into shot gun cans through a gauze strainer having three or four thicknesses of butter cloth fastened on the underside by means of a tin ring, which slips over the rim on the bottom of the strainer, thus securely fastening the cloth, and making an almost perfect strainer. The milk is removed from the stable to the dairy as quickly as possible after it is milked, and again strained before it is run through the cream separator. When all the cows are milked they are taken to the pasture. The stable is thoroughly cleaned out after each milking and the floor sprinkled with land plaster, the windows and doors being kept open as much as possible to give the stable a good airing.

Later in the season when the pastures begin to dry up we shall feed to each cow *in the stable* from twenty to thirty pounds a day of green peas and oats, of which we have about three-quarters of an acre growing vigorously at the present time. Later we shall feed about the same quantity of green tares and oats, of which we have about an acre and a-quarter, sown ten or twelve days after the peas and oats. Later still we shall feed green corn, of which we have about two acres. We are thus prepared for a dry season if it comes, and if we do not require these to feed in summer they will be cured and kept for the winter.

In the Dairy. We have been using a Laval "Baby" separator, No. 2 (hand power), for over a year, and like it very much. Recently we have purchased an Alexandra No. 8, and although we have not yet used it a similar machine has been in use at the Farm for some time, and is giving good satisfaction. It is a cheaper machine than the Laval. Our method of using is as follows: After the speed of the bowl has been attained the tap is opened from the supply can, and the warm milk allowed to flow into the machine. *It is very important to attain the normal speed of the machine before allowing any milk to flow into the bowl.* Some have had trouble from lack of care in this particular. When the last of the whole milk is out of the supply can we run about a gallon of skim-milk through, and lastly about the same amount of warm water, to clean the cream out of the bowl. The cream is then cooled down to about 45° Fahrenheit, the machine and all utensils thoroughly washed, and the dairy made neat and tidy—as every dairy should be. The skim-milk is then taken back to the stable for the calves, and the cream put into the cream pail and kept cool until twenty-four hours before we wish to churn. (I may say that I think a preferable plan would be to have a neat, clean room in or near the stable, where the separator might be set, and when separated the cream could be taken to the dairy or cellar, while the skim-milk would be where it is wanted for feeding.) The cream is kept in one large (ten gallon) tin can, which has a *tin* spoon in it for stirring at every addition of fresh cream, and also for stirring when the cream is either cooled or warmed.

Sometimes the milk is set in deep cans or creamers, in cold or ice water. When this is done the milk is put in the cans while warm, and cooled to at least 45° Fahrenheit before skimming, which is usually done at the end of twelve hours. After skimming the cream is handled in the same way as from the separator, except that it is not cooled, it being already cold enough.

Those who still use the small shallow pan should set where the air is pure, the temperature even (fifty to sixty degrees), and skim always before the milk becomes thick. Do not be afraid to take off some skim-milk along with the cream.

CHURNING. We churn three times a week—Monday, Wednesday and Saturday. The night before we churn the cream is warmed to about 65° by setting the cream can in another vessel containing water at about 90° to 100°. We use a large can, but a washtub will answer the purpose very well. The cream is kept stirred until it gets to the proper temperature, when it is either placed in a "Boyd Ripening Vat," or set in a room where the temperature is about the same as the cream. The next afternoon the churning is done, but when the weather becomes very warm we shall churn in the morning while it is cool. The cream will also be set to ripen earlier if necessary. This matter of ripening or souring of the cream is a very important one in preparing butter for the present market, and to get a profitable yield of butter. The only rule that I can give at present as to when the cream is ripe or sour enough is that as soon as it gets about as thick as good maple syrup, tastes slightly sour, and has begun to separate into small particles it is ready to churn, and we then churn it without allowing it to stand any longer.

Our average temperature for churning during summer is 58°—ranging one or two degrees higher or lower according to circumstances. The cream is brought to this temperature in a manner similar to preparing it for ripening; it is then weighed and strained through a perforated tin strainer into the churn. The cream can is then rinsed out with a little water. For every ten pounds of cream we add one dram (about half a teaspoonful) of Hansen's or Yorkshire butter color. This is done before starting the churn, and for the purpose of imparting a "June grass color" to the butter.

The churn we use is a No. 5 "Daisy." Two or three times during the first ten minutes of churning the plug at the bottom is removed to allow the gas to escape. Churning usually occupies from fifteen to twenty minutes—seldom over half an hour. The churn revolves at the rate of sixty or seventy turns to the minute. As soon as the butter "breaks," which we can tell by the swishing sound, or by the clearing of the glass in the cover, we add a quart or two of water for each pailful of cream, the temperature of the water varying with the day and the condition of the cream. On a warm day one can scarcely have the water too cold, as it will then chill the particles of butter and make them firm, while at the same time the water dilutes the buttermilk, allowing a more perfect separation of the butter. The churning then continues until the butter granules are about the size of grains of wheat or a little smaller, when the churn is stopped, the buttermilk drawn off from below and strained through the strainer previously mentioned for the cream. This strainer serves to catch any particles of butter which may come out with the buttermilk; but if the separation has been complete the butter will float on the top and none appear in the buttermilk until the very last. We next add cold water or weak brine in quantity sufficient to float the butter and wash out the butter-milk. We usually half fill the churn with water, give it a few rapid turns, and draw off the milky water. The operation is repeated with pure cold water, which generally comes away clear. If it is not clear, water is added the third time. The butter is then allowed to drain in the churn for fifteen minutes or half an hour, and sometimes the salt is added while still in the churn; but as a rule the butter is removed from the churn, placed in a butter-tub and weighed. It is then spread upon a V shaped worker that slants towards the front and has a lever fastened at the lower end. Fine salt at the rate of one ounce for each pound of butter as it comes from the churn is now sifted on by means of a hair sieve. After sifting on about half of it the butter and salt are gently stirred, when the rest of the salt is added, and the butter worked by means of the lever. We work sufficiently to remove the excess of water, to thoroughly incorporate the salt in every particle of butter, thus preventing "streaks," and making a firm, compact body. The butter is then put up in pound prints made by means of Carver's butter mould, or a mould made by Moyer & Son, Toronto. These may be gauged so as to print a pound quite accurately, and their use saves a great deal of labor. Each print is then wrapped in parchment butter paper—one sheet wrapping a pound. On these sheets is printed, in such a way that when folded the words appear on the top of each block, the following, which serves as an advertisement:

FRESH BUTTER

MADE AND PUT UP BY THE

EXPERIMENTAL DAIRY,

GUELPH.

We never had enough at one churning to make a shipment, so the blocks of butter are put in the box. This box is made of wood, containing four *wooden* trays, with an opening down the centre in which is placed a tin vessel filled with ice, and the whole is kept in a cool room until the box is full, when it is taken to a commission merchant in the city of Guelph.

There are perhaps fifty ways of making good butter, and I do not claim that ours is the best. There are scarcely two persons that pursue exactly the same method in all the details, but I think the plan here outlined will, if carried out in any dairy, give butter that no one need be ashamed to have a buyer examine.

THINGS WE DO NOT DO.

1. We do not consider that we know everything about butter-making, as something new is being discovered every month. Not only from our own work are we continually learning, but also from the observation and research of others.

2. We do not keep a cow that makes less than 200 pounds of butter in a year;

3. Nor put the dry cow on a starvation ration;

4. Nor expect a cow to make something out of nothing;

5. Nor keep our cows in an ice-house, hog-pen or dungeon;

6. Nor allow them to go a whole year without carding or brushing them.

7. Nor depend upon pasture alone for a supply of summer feed.

8. We do not allow the milk to stand very long in the stable to absorb foul odors.

9. We do not neglect to strain the milk at once after milking;

10. Nor set the milk in deep cans in well water without changing the water at least twice, or without ice;

11. Nor mix sweet cream with cream to be churned less than twelve hours before churning. (The cream is ripened in one vessel which holds the cream for a whole churning);

12. Nor add scalding water to the cream; nor guess at the temperature with the finger; nor take two or three hours to churn;

13. Nor gather the butter until the "dasher stands on top," and then dip it out of the buttermilk;

14. Nor add coarse salt by guess; nor work the butter into grease.

15. And finally, we do not send our butter to market wrapped in old rags that may have seen other service in the home.

To those who wish something more extensive than can be presented in a bulletin, we have much pleasure in recommending a pamphlet published by Smallfield & Sons, Renfrew, Ont., costing ten cents; and also a publication by Mrs. E. M. Jones, of Brockville, Ont., costing about twenty cents, which is now in press.

BULLETIN LXXVI.

BUTTER-FAT IN MILK AND CREAM.

VARIATION IN FAT OF MILK FROM THE HERD AND FROM INDIVIDUAL COWS OF THE HERD.

How wide a variation one may expect to find in the fat of milk from individual cows and from a whole herd is a question not yet settled. For over a year we have been testing each of our cows twice a week (morning and evening), some four times a week and some eight times a week. We find that while individual cows may and do vary widely in the per cent. of fat from day to day yet the milk from the whole herd does not exhibit such wide variation in quality—in fact tests made during the month of January, February, March and April show that the per cent. of fat is quite constant.

The following table gives the amounts of fat (per cent.) found in the milk of eight cows, morning and evening as determined in eight days:

		Jan. 11.	Jan. 27.	Jan. 28.	Jan. 29.	Feb. 19.	Feb. 20.	Feb. 29.	Mar. 8.
No. 2 ..	Morning	5.3	4.0	4.6	4.6	3.8	3.5	4.2	4.1
	Evening	4.2	4.8	4.5	3.9	4.4	......	5.0	4.2
No. 4 ..	Morning	3.8	4.2	4.4	4.4	3.5	3.2	3.8	3.7
	Evening	3.2	4.6	4.2	4.3	4.4	.... .	4.5	4.2
No. 6 ..	Morning	3.5	3.9	4.0	4.0	3.6	3.4	3.5	3.5
	Evening	3.5	4.0	4.0	3.7	3.8	......	3.8	3.4
A. 2....	Morning	2.5	3.0	3.7	3.3	......	3.1	3.5	3.0
	Evening	3.6	3.8	4.0	4.2	4.6	......	3.5	3.1
H. 1 ...	Morning	2.7	2.9	3.2	3.0	......	3.2	......	......
	Evening	2.6	3.5	2.8	2.5	3.6	......	......	......
H. 2 ...	Morning	2.8	3.0	3.0	3.0	......	2.8	3.2	3.1
	Evening	3.1	3.0	3.2	2.6	3.2	......	3.2	3.0
J. G. 1.	Morning	2.8	4.5	4.8	4.6	......	4.0	4.0	4.1
	Evening	4.2	4.8	4.9	4.4	4.8	......	4.4	3.7
No. 13 .	Morning	2.3	4.0	4.6	4.4	......	......	....	......
	Evening	4.8	5.3	4.6	4.4	.. ..	.....	......	......

The following statement gives the highest, the lowest and the average per cent. of fat found in *the mixed milk from the whole herd* tested during the months of January, February, March and April. For a part of the time the fat was determined separately in the morning and evening milk, and in sixteen tests made in March the mixed milk of morning and evening was used.

——	Highest.	Lowest.	Average.
Morning milk, 43 trials	3.90	3.05	3.53
Evening milk, 25 trials	4.15	3.40	3.63
Morning and evening milk mixed, 16 trials	3.90	3.30	3.60

From this statement it appears that the widest variation in the morning milk during 43 trials was 0.85 per cent., in the evening milk during 25 trials 0.75 per cent., and in the combined morning and evening milk during 16 trials 0.60 per cent.

TOTAL SOLIDS IN MILK ESTIMATED FROM THE PER CENT. OF FAT AND THE LACTOMETER READING.

With our present short methods of determining the fat of milk, this part of dairy work has become comparatively easy. In cases where it is thought advisable to determine the solids not fat in the milk as well as the fat, it may be done approximately by the use of the Quevenne Lactometer (together with the fat per cent.) by the following formula recommended by Dr. Babcock :

$$\text{Solids not fat} = \frac{L + 0.7F}{3.8}$$

$$\text{Total Solids} = \frac{L + 0.7F}{3.8} + F.$$

L is lacometer reading at 60° F.

F is the per cent. of fat.

A shorter rule which will give approximately the same results is to add the per cent. of fat to the lactometer reading and divide by 4—this gives the solids not fat. The total solids are then found, of course, simply by adding together the fat and the solids not fat.

Comparing results obtained by the use of this formula with those obtained by chemical analysis, we have found the following results in the milk from six cows, the average of the trials of each cow being given :

——	Cow No. 2.	No. 4.	A. No. 2.	H. No. 2.	No. 13.	A. No. 3.	Average.
No. of trials	5	7	7	7	6	7	39
Lactometer reading	30.6	33.3	32.62	31.96	31.76	33.10	32.22
Fat according to Babcock test.	4.14	3.86	3.34	2.89	3.22	3.86	3.55
Solids not fat by formula	8.77	9.48	9.20	8.94	8.83	9.41	9.11
Solids not fat by chem. analy's	8.29	9.37	9.10	8.72	8.53	8.98	8.83
Total solids by formula	12.91	13.34	12.54	11.83	12.05	13.27	12.66
Total solids by chem. analysis	12.43	13.23	12.44	11.61	11.75	12.84	12.38
Difference between formula and analysis	0.48	0.11	0.10	0.22	0.30	0.43	0.26

The average difference in the thirty-nine samples between the total solids as determined by the formula and by chemical analysis was only *0.26 of one per cent.*, almost within the limits of error. This method promises to prove of value in ordinary experimental work or in the rapid analysis of milk, as thereby we may obtain approximately the per cent. of water, of fat, of solids not fat, and of total solids, in a few minutes and at small cost.

PAY FOR MILK ACCORDING TO PER CENT. OF FAT.

Quality is of more importance than quantity in nearly everything Quality or per cent. of fat is what the butter-maker desires most of all in the milk designed for the manufacture of butter, because butter is largely composed of fat—about 84 per cent. Therefore the fat in milk is an index of its value for butter.

It is also a proper basis on which to value milk for cheese-making, because—

1. The serum or pure skim-milk is worth only from 15 to 20 cents per 100 pounds, while the fat is worth from 15 to 30 cents per pound whether in cheese or in butter.
2. The casein or curd is fairly constant in all milk, while the fat varies widely in different samples.
3. The richer the milk in fat up to a certain limit the more pounds of cheese may be made from a given number of pounds of milk.
4. This method will give to each patron more nearly what is just than any other system that has yet been tried, besides taking away all temptation to tamper with milk designed for the manufacture of cheese or butter.

TESTING MILK.

The testing of each patron's milk involves considerable labor; hence, we should study how to lessen the labor as much as possible. A device which we have used in the dairy building here for over a year makes the work of measuring and adding the acid very slight. A gallon bottle is kept full of acid. This bottle has an ordinary cork containing three openings—one for a glass syphon having a glass stop-cock, one for a glass funnel, and one small opening to allow the air to escape when the bottle is filled with acid. Such a bottle and syphon has been in use for about fifteen months and requires no attention, neither has it given any trouble or needed repair. With two acid measures, one of which is filling while the acid from the other is being poured into the test bottle containing the milk, the work proceeds very rapidly.

Several inquiries have been made as to the cause of "curdy, crumbly matter" in connection with the fat when making tests with the Babcock tester. The causes are, I think, two:

1. Insufficient mixing of the acid and milk, or in some cases the acid is too weak.
2. Not keeping the bottles properly cleaned. If these become greasy they should be washed with soap-suds or sal-soda water. A small brush should be used for cleaning the neck of the bottle.

TESTING WHEY.

Every cheese-maker should test the whey each day from the vats, and thus check any losses of fat from this source. The drippings from the cheese ought also to be tested, as frequently there is considerable loss of valuable constituents by improper handling and pressing.

To test whey take the same amount as for new milk (17.6 c.c.), but only half the usual quantity of acid; or better still, get bottles which are specially made for testing whey and skim-milk. These bottles require twice the ordinary quantity of whey or skim-milk, and the ordinary quantity (17.5 c.c.) of acid.

KEEPING WHEY AND SKIM-MILK SWEET.

A question was asked of us recently: "Can skim-milk be treated so as to keep sweet for twenty-four hours?"

The answer was, yes, both whey and skim-milk may be kept sweet twenty-four hours in the hottest weather by heating to 150° or 160° Fahrenheit. This treatment kills the germs which cause the souring of milk and milk products. Most factories have steam, and the cost of heating the bye-products to a sufficiently high temperature to preserve them sweet would cost very little.

It has been demonstrated that *sweet* whey for feeding hogs is worth from eight to ten cents per hundred pounds compared with middlings and corn. What sour, stinking whey is worth has never been shown. We doubt whether it more than pays for the labor of hauling it to the farm and the feeding of it to the only class of animals that can thrive on it at all.

THE FAT OF CREAM.

The present system of distributing proceeds to patrons of both cheese factories and creameries is causing distrust in the minds of operators and patrons. That it does not do justice in a cheese factory is conceded by nearly all. That the paying for milk according to quality or on its fat basis is much more just is also pretty well established. That the fat basis is the proper one to adopt at a centrifugal or separator creamery none deny. Whether the test for fat, or the Babcock test, is likely to supplant the "oil test" in cream-gathering creameries is a query among creamery men at present. A leading firm sent the following to this department recently: "We have had several inquiries with regard to the practicability of applying the Babcock tester with the bottles made to test cream, and we have been asked our opinion as to whether this will answer for factories which are working on the cream-gathering principle. We have the bottles, which will show twenty-five per cent. of butter fat, and we suppose they can be made to go still higher. What is your opinion about this matter? Do you think that the Babcock with these cream bottles can be made to take the place of the oil-test churn?"

In testing cream the following points require attention:

1. It is difficult to sample sour, thick cream properly. In this case it is best to dilute it with an equal volume of water and multiply the readings by two. For cream containing over twenty-five per cent. of fat a bottle with a detachable neck reading to thirty-six per cent. of fat may be used (for description see Maine Report, Part II., 1891), or the sample may be divided into two bottles.

2. Sweet cream raised by cold, deep setting process may be sampled without difficulty. The pipette should be rinsed into the test bottle with a small amount of water.

3. The cream bottles cannot be used in one of our machines which has swinging pockets, but can be used in another in which the pockets are stationary.

4. In adding hot water after the whirling, care should be exercised that the bottom of the column of fat does not come in the bulb, which is not graduated.

5. If creameries adopt this plan great care should be observed in taking the samples that they may be fair representatives of the whole of the cream.

6. This test gives the *absolute* amount of fat in the cream, and judging from the trials previously noted we may expect more pounds of butter than there are pounds of fat in the cream.

We have made several determinations (by the Babcock method) of the fat contained in cream, with the following results : In testing cream a pipette measuring 18 c.c. is required. The bottles we use are graduated to read up to 25 per cent. of fat. The neck has a bulb and the same amount of acid is used as for whole milk.

Date.	Per cent. fat in cream.	Total lb. fat in cream.	lb. butter yielded.	lb. fat for one lb. butter.	Per cent. of fat in buttermilk.
May 18	18.9	9.64	10.25	0.94	.....
" 21	18.1	4.98	5.50	0.91	0.10
" 21	17.2	3.10	3.60	0.86	0.10
" 21	20.0	3.49	3.40	1.03	.....
" 23	20.6	16.10	20.20	0.79	.....
" 26	27.2	9.52	12.00	0.79	.....
" 28	16.6	4.15	5.50	0.76	0.10
" 28	15.0	4.28	5.50	0.78	0.10
" 28	14.6	2.34	3.00	0.77	0.05
June 4	17.0	4.08	4.90	0.83	0.20
" 4	18.2	3.09	3.60	0.86	.....
Average	18.5	5.89	7.04	0.84	.....

To divide the cash proceeds at a creamery the following plan may be followed :

A	delivers	500	lb. cream containing	25	per cent. fat, or	125	lb. fat.
B	"	600	"	20	"	120	"
C	"	400	"	15	"	60	"
					Total delivery is	305	"

Sale of butter gives 350 lb. at 20c. or $70.

The net value of each pound of fat delivered therefore is $70 divided by 305 or 22.95 cents.

Therefore—

A's	share is	22.95 × 125	or	$28.68
B's	"	22.95 × 120	"	27.54
C's	"	22.95 × 60	"	13.77
Total divided,				$69 99

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXVII.

FATTENING LAMBS.

BULLETIN LXXVIII.

FATTENING LAMBS FOR THE BRITISH MARKET.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B.S.A., EXPERIMENTALIST.

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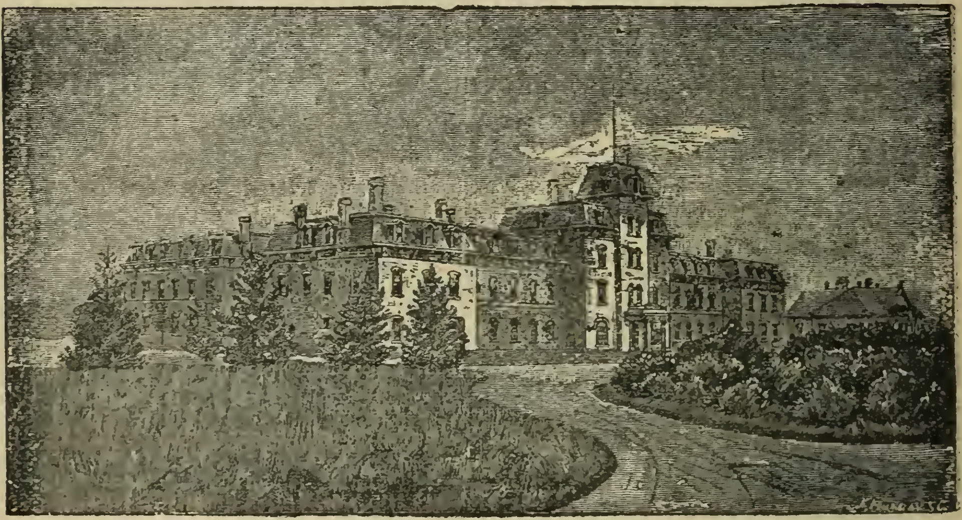

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BULLETIN LXXVII.

FATTENING LAMBS.

A large acreage of rape has been grown at this station for two years past. It has been grown for the two-fold purpose of cleaning the land and of providing pasture for sheep and lambs in the autumn. The growth of the rape has necessitated the purchase of a large number of lambs during both seasons to feed it off. For this purpose 666 lambs were purchased in the autumn of 1891 and brought to the station. There was also the further object in view of continuing the fattening process in different ways during the winter months as might be thought best. In the Annual Report for 1891, p. 139, the number purchased is given as 676, but the reference there includes ten lambs bought of necessity and sold again without bringing them to the station, on the ground of unsuitability. They are in no way mixed up with the lot in this bulletin.

The particulars relating to the purchase of these lambs are summarized as below :

Date of purchase.		Where bought.	Cost when laid down at the station.
Aug.	29,	200 lambs in Eastern Ontario	$ 669 10
Sept.	14,	200 lambs in Prince Edward Island.	552 61
Oct.	7,	162 lambs in Prince Edward Island	483 98
"	20,	104 lambs in Toronto	391 65
		Total	2,097 34

The cost of the purchase and carriage of the 362 lambs from Prince Edward Island to Guelph averaged 95c per head, or 49⅓ per cent. of the purchase price of the lambs, the distance being from 1,100 to 1,200 miles between the two places.

The chief of the reasons which led to the purchase of the lambs at so great a distance include the following :

1. To encourage in all parts of the Dominion the finishing of lambs in finer form than is usual. In nearly all parts of Canada, and more especially in the outlying portions, it is the practice to put lambs upon the market in the late summer or the early autumn months, with no other finish than that furnished them by pastures which are oftentimes ill-adapted to the purpose.

2. To demonstrate that such lambs as we have at present can be so handled that they will bring a price much in advance of that ordinarily obtained for them. When nearly all farmers who own lambs sell them in an unfinished condition, and at or near the same time, the price received for them is in consequence discouragingly

low. But while we seek further improvement in the mode of handling such lambs as we have, we are convinced at the same time that every reasonable effort should be made to improve the breeding of our lambs, which manifestly is far from what it ought to be.

3. To demonstrate the helpfulness of rape as an aid in fattening lambs, whether they are to be sold at the close of the pasturing season or carried on into the winter months and sold in completer form and at higher prices. The growing of rape in Ontario is as yet understood by but a limited number of farmers, while in the other provinces of the Dominion it is known to scarcely any extent.

Character of the lambs. The lambs purchased in eastern Ontario were a fairly good lot though small in size, as will be seen by reference to the average weights given below. The lambs from Prince Edward Island were light and small. Some of them showed traces of the Down cross. Those purchased in the Toronto market were larger in body than the lambs bought in eastern Ontario, and leaner in flesh. They were much mixed in breeding and variable in character. In the lots from Prince Edward Island and Toronto were 164 rams. These were all castrated soon after their arrival, and but one died in consequence of the operation.

Management on arrival. The lambs bought in eastern Ontario which arrived at the station on August 29th, were weighed singly on September 2nd, and were ear-tagged at the same time. On September 16th they were put upon the rape. The first lot from Prince Edward Island arrived September 14th, and were put upon the rape September 17th. On September 26th they were ear-tagged and weighed singly. Owing to the long transit to which they had been subjected, it was thought unfair to weigh them sooner. The second lot from Prince Edward Island arrived October 7th, and were ear-tagged and weighed and put upon the rape October 15th. Those bought in Toronto which arrived October 21st were weighed on their arrival and were at once put upon the rape, with the exception of the newly castrated rams. The lambs of the previously mentioned lots were fasted from 15 to 18 hours before they were weighed.

The average weight of the lambs in each group when weighed at the dates mentioned, and the average cost per pound of live weight when laid down at the farm, are given in Table I.

Date of weighing.	Place where bought.	Average weight of each lamb.	Average cost of each lamb.	Average cost per lb. of live weight.
		lb.	$ c.	c.
Sept. 2..	Eastern Ontario	67.54	3 35	4.96
Sept. 26..	Prince Edward Island	53.18	2 76	5.19
Oct. 15..	Prince Edward Island	59.70	2 99	5.08
Oct. 20..	Toronto	77.74	3 76	4.83

The prices paid, therefore, including the cost of purchasing and of transit were relatively dear. The prices given for lambs when the first three lots were purchased were comparatively high, hence the serious losses to dealers who were bound to lift the lambs before the holiday season. The lambs were allowed to remain upon the rape until it was all eaten. They had access at will to an old pasture, a part of it being woodland, the thick underwood of which afforded some protection for the lambs in times of the early snows. As many as 500 fed in one field at one time and these are the lambs shown in the sketch published in the Annual Report for 1891, p. 103.

The rape crop included 40 acres grown in drills and 6 acres grown as a catch crop after winter wheat. A crop of rye cut for fodder and for the silo in June preceded the 40 acres of rape grown in drills. (See Annual Report for 1891, p. 53.)

Winter quarters. A lot of 100 lambs were shorn Oct. 13th to 16th and put into winter quarters at night and on stormy days. They were pastured on rape on fair days and had the same carted to them on stormy days. Another lot of 20 lambs were separated on Nov. 28th to be fed for experiment as shorn against unshorn. Full particulars will be given regarding these two lots in future bulletins.

The remainder were put into winter quarters on Dec. 10th. We found it necessary to provide additional shelter. For this purpose old fence lumber was used. Sheds were erected involving but little cost and labor. Each shed had a yard in front and there were more than 150 lambs in each shed. They were too much crowded or doubtless they would have done better.

The lambs were weighed on Dec. 10th. We were strongly advised to sell them at that time, but owing to a glut in the market we could not obtain an offer of more than 4⅜ cents per pound for immediate shipment. On January 1st 1892 we refused an offer of 5¼ cents per pound live weight on the whole lot to be delivered at once. The difference between the first and second of these offers in the aggregate value of the lambs is $575, not taking into the account food, manure and attendance for the 21 intervening days. The aim therefore should be when fattening lambs to have them ready for market at that season of the year when good prices are given. In future, this season is more likely to be the months coming after the opening of the year rather than those preceding it.

Food and Feeding. The food given to the lambs consisted of hay, some oats in the sheaf, roots and a grain ration of oats and peas fed whole. The lambs in the experiments already mentioned were given in addition a small proportion of bran and some ensilage. The hay was clovery and it was fed uncut. The roots were sliced and they consisted of turnips only. But two feeds were given per day and water was given in troughs daily. Salt was liberally supplied.

Estimated value of the Food. The fodder, the grain and the roots were estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. (See Bulletin LXVIII, p. 5.) The home value, therefore, put upon the hay was $9 per ton, the unthreshed oats $6, the roots sliced 6 cents per bushel, the oats 26 cents, and the peas 50 cents. The bran was valued at $14 per ton and the silage at $2.

Food consumed. The amount of food consumed by the lambs, not including the rape, from the time they reached the farm until they were delivered for shipment, and the respective values of the same are as follows:

Food.	Value.
Hay, 54,396 lb	$244 78
Oats in sheaf, 4,040 lb	12 12
Oats, 57,332 lb	438 42
Peas, 11,458 lb	105 03
Bran, 3,212 lb	22 48
Roots, 128,774 lb	128 77
Silage, 9,050 lb	9 05
Total	$960 65

Disposal of the Lambs. The lambs were delivered for shipment as stated in Table II below:

Dates of sales.	Markets.	No. of lambs in each sale.	Weight of each group sold.	Price per lb.	Total value of each group.
			lb.	c.	$ c.
January 8	Buffalo	160	13,573	5½	746 51
March 8	Ontario	50	3,340	5⅝	187 87
March 9	Halifax	126	11,450	5⅝	644 06
April 12	Halifax	63	5,900	6	354 00
May 9	England	99	13,103	7	917 21
April 26	Ontario	99	8,660	6	519 60
April 12	Halifax	20	2,738	7	191 66
	Ontario	26			68 50
	Ontario	17 (skins)			12 75
	Died on transit or strayed.	6			
Total					$3,642 16

The lambs which are represented as having been sold at a low price in the home market were ill-doers. From the 23 lambs which died on transit or afterwards, the only revenue was that obtained from the skins of 17 head, while they are all charged against the experiment. It will also be observed that the price received increases with the advance of the season. The figures in the right hand column of Table II, as also those previously given relating to the cost of the lambs have been compiled from the books of the bursar, from which source they can easily be verified. This is mentioned because of statements made more than once that feeding these lambs was a losing game. The only exceptions are found in the case of ten cull lambs not yet delivered and those sent to England. The price put upon the latter, as stated in the table is 7 cents per pound, since we refused an offer of that amount from Mr. L. O. Barber, Guelph, on April 12th for immediate shipment. At that date Mr. Barber, who bought all the different lots except the culls, paid us 7 cents per pound for a lot of 20 lambs very similar in quality. We refused the offer for the reason that the lambs had been fed for the British market.

Table III contains a financial summary covering the whole transaction :

Cost of the lambs when bought	$2,097 34	
" shearing 120 lambs	5 40	
" food, including rape and pasture	1,316 25	
" attendance	125 00	
Total cost		$3,543 99
Value of lambs when sold	$3,642 16	
" " wool	56 60	
" " manure	577 12	
Total value		$4,275 88
Gain		731 89
" per lamb		1 10

The net cash actually received for the 99 lambs shipped to England would reduce the above gain by $132.10.

The 120 lambs included in the item cost of shearing were shorn for experimental purposes. All the food given to the lambs from first to last is charged against them. The estimate put upon the rape was the cost of the cultivation as given on page 6, Bulletin LX. This makes the cost of growing the rape $8.46 instead of $11.77 as stated in the aforementioned bulletin, owing to the difference in the amount of the manure applied. The cost of producing the six acres grown as a catch crop was estimated at $1.20 per acre, as nearly all of it was sown broadcast and after the necessary autumn plowing of stubble land. It should be remembered that all the rape grown was a second crop taken from the land during 1891, and that the cultivation given to it left the land in a very clean condition. The whole time of one person was occupied in caring for the lambs, but more than one-half of it was taken up with those under experiment. But we have charged a little more than half the wages actually paid, against the lambs, to make sure no undue favor would be shown where the exact apportionment is an uncertain element.

The manure was valued at half a cent per day per lamb. This estimate is much lower than the value put upon the manure produced by sheep and lambs by experiment stations which have made this question the subject of careful investigation. But we desire to put these things moderately, as samples of the manure made by the lambs sent to England are now being analysed, we hope to speak more authoritatively in reference to this matter in the following bulletin. As in former bulletins, no account is taken of interest on money, rent of land, exhaustion of natural fertility, or of the increased value resulting from the cleaner tillage of the land.

We now give a concise summary statement of the whole transaction without considering the value of the rape eaten, the cost of attendance or the value of the manure :

Total cost of 666 lambs when laid down at Guelph	$2,097	34
Cost of shearing	5	40
" food	960	65
Total cost	$3,063	39
Total value of 666 lambs	3,698	76
Net gain on 666 lambs	635	37
" per lamb	0	95

CONCLUSIONS.

1. That the average grade lamb of the Dominion is an animal much inferior to what it ought to be and to what it may be made.

2. That rape furnishes an excellent pasture for fattening lambs and an easy means of manuring the land.

3. That pasturing lambs on rape is an excellent preparation for winter fattening.

4. That it is easily possible to fatten a large number of lambs upon the food grown upon a limited area when the work is judiciously done.

5. That where the facilities are at hand one attendant can care for a large number of lambs fattened on the lines followed in this experiment.

6. That in fattening lambs it is important to be able to carry them on past that autumnal season when the market is most liable to be glutted.

7. That in fattening lambs a substantial profit may be made even from such lambs as we have, when the work is done on the lines indicated in this bulletin.

BULLETIN LXXVIII.

FATTENING LAMBS FOR THE BRITISH MARKET.

This experiment commenced with the arrival of the lambs at the farm in the months of September and October, 1891. The whole lot of lambs purchased are more fully described in bulletin LXXVII which treats of "fattening lambs." It closed when the lambs were sold in Liverpool shortly after the middle of May of the present year. They left the farm for the British market on May 11th. It was intended to be substantially a repetition of the experiment the particulars of which are given in Bulletin LXIX. The principal objects of the experiment were to ascertain, (1), whether lambs can be fattened at a profit in the autumn and winter for the English market, and (2), whether the average grade lambs of Ontario and Prince Edward Island are suitable for the purpose.

THE ANIMALS SELECTED. The lambs from which those intended for shipment were selected were purchased by Mr. J. E. Storey, the farm foreman, in the eastern part of Ontario, and in Prince Edward Island. There were purchased in all 666 grade lambs, of which 200 came from eastern Ontario, 362 from Prince Edward Island, and 104 from Toronto. The selections for this experiment were made from the eastern Ontario and Prince Edward Island lambs, 55 from the former lot and 45 from the latter. The lambs were a mixed lot and somewhat below the average of Canadian grade lambs in quality, as will be apparent from the weights given further on. They evidently possessed but little improved blood, and were considerably below what the standard lamb of Ontario should be. In selecting, the preference was given to those having dark faces, although a considerable number were not of this class.

CONDITIONS GOVERNING THE EXPERIMENT. The lambs selected from the lot purchased in eastern Ontario were weighed on September 1st, two days after their arrival at the farm. Thirty-seven of those selected from Prince Edward Island were weighed September 26th, twelve days after their arrival, and the remaining from the same place on October 15th, eight days after their arrival. The average weight of the Ontario lambs was 77.5 lb., and of those from Prince Edward Island 67.9 lb. They were all ear-tagged on their arrival at the farm, hence the behavior of each lamb could be traced without difficulty throughout the experiment. From October 13th to 16th they were shorn. They were then allowed to go together in a closed shed with yards attached until the latter part of December, although while the weather continued suitable they were pastured on rape during the day. The shed was then divided into four equal compartments, and 25 lambs put in each of these to be fed on different rations. These rations and all the particulars relating to this sub-experiment will be given in connection with the experiment on "feeding shorn and unshorn lambs," to be issued in bulletin form in the near future.

FOOD AND FEEDING. From the time of the first weighing until Oct. 13th the lambs were kept on rape all the time. They were then allowed access to the rape only on fine days, and were housed at other times as already mentioned. When inside they received hay, roots and grain until the latter part of December, at which time the experiment was commenced, to which reference has already been made. This sub-experiment continued until April 30th. During its continuance the lambs in one group were fed a mixed grain ration, roots and hay, in a second a grain ration of whole oats with roots and hay, in a third a mixed grain ration with ensilage and hay, and in the fourth a ration similar to that given to the lambs in the first mentioned group, except for a short time at the first. From the close of the sub-experiment until the lambs were shipped on May 11th they were all fed upon a mixed grain ration with roots and hay. The mixed grain throughout the experiment consisted of oats, peas and bran, fed in the proportion of 2, 2 and 1 parts. The oats and peas were all fed unground. The roots consisted of turnips, sliced. The hay was all fed uncut. It consisted of clover and timothy. The grain ration was increased in quantity as the season advanced. It will be noticed that the period of pasturing rape was considerably curtailed by the shearing of the lambs, although some rape was carted to them in addition to what they got when pasturing, and this is all accounted for in the computation. The ensilage was fed to but one group of lambs and then only during the continuance of the sub-experiment. The food consumed by the 100 lambs throughout the experiment was as follows :

Oats	14,344	lb.
Peas	5,099	"
Bran	2,594	"
Roots	43,560	"
Hay	26,587	"
Ensilage	9,050	"

Rape, what grew upon 4.52 acres.

The average daily consumption of food from October 16th to

May 11th, exclusive of a very limited quantity of rape given them for a limited period at the first, was :

Grain	1.06 lb.
Roots and ensilage	2.54 “
Hay	1.27 “
Total	4.87 lb.

ESTIMATED VALUE OF THE FOOD. The food was estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions (see Bulletin LXVIII). The home value put upon the food by this mode of reckoning was : Oats 26 cts. per bushel ; peas 50 cts.; bran $14 per ton ; roots, sliced, 6 cts. per bushel ; ensilage $2 per ton ; and hay $9 per ton. It will be observed that in all probability a profit has already been made on the marketable food used, providing it has been grown upon the farm, as in this experiment the food was charged at the full market values, less the cost of marketing from an average Ontario farm. This profit would be represented by the difference between the cost of growing the food and the market value put upon it.

WEIGHTS. Table I gives a summary and an analysis of weights :

——	The lambs from Eastern Ontario.	The lambs from P. E. Island.	The whole lot of 100 lambs.
	lb.	lb.	lb.
Total aggregate weight at commencement			7,322
“ aggregate weight at close			13,218
“ increase in weight			5,896
Average individual weight at commencement	77.50	67.90	73.20
“ “ “ the close	134.90	128.80	132.20
“ “ increase			58.96
“ “ daily increase			.25
“ increase per month	6.78	9.99	8.39
“ “ “ while on rape			8.51
“ “ “ on a winter ration			7.72
“ “ “ without fleece			7.40
“ “ “ with fleece			7.85

It will be observed that the lambs brought from Prince Edward Island increased more rapidly in weight than those from eastern Ontario, although they were lighter at the outset. They were somewhat leaner in flesh when the experiment started, and this may furnish the explanation. In any case the gains were very satisfactory for the food consumed.

TRANSPORTATION. The lambs were put on board the cars at Guelph on May 11th, en route for Liverpool. They left in charge of the farm foreman, Mr. J. E. Storey, who accompanied them as far as Montreal, put them on board an ocean steamer along with the food necessary for the voyage, and secured a competent feeder to care for them on the way.

One of the lot had been sold before the date of shipment to a local butcher, as it was deemed unsuitable for the foreign market. The price obtained was $5. The whole number sent over therefore was 99. They all stood the voyage well and arrived in Liverpool in good condition.

DISPOSAL OF THE LAMBS. On arriving in Liverpool the lambs were taken in charge by Mr. G. F. Frankland, ex-alderman of Toronto, who found a ready market for them. They brought the highest prices that were then being paid for choice lambs, although the beef market at that time was in a very depressed condition.

In regard to them Mr. Frankland reported : 1. That they sold well in competition with the best mutton of Wales and Scotland. 2. That while sheep brought alive from South America sold for but 6d. per pound, dressed weight, these lambs brought 8½d. per pound. 3. That they were sold to the highest bidder, a leading butcher of Manchester, for £2 7s. 6d. each. 4. That they were carefully examined by dealers who pronounced favorably upon their merits, and that they were much admired by people of various classes. In reference to this Mr. Frankland says, " You would have rejoiced to have seen the droves of good men from 30 to 80 years of age examining your lambs."

VALUES. Table II gives the financial results of the experiment.

	Values.
	$ c.
Cost of 100 Lambs when landed in Guelph	368 74
" shearing	5 00
" food	380 83
" attendance	25 00
" shipping to England	357 69
Total cost	1,137 26
Value of 99 lambs in England	1,141 60
" 1 lamb in Ontario	5 00
" wool	44 33
" manure	237 74
Total value	1,428 67
Total gain	291 41
Gain per lamb	2 91

The value put upon the lambs at the commencement of the experiment was the actual cost per pound when laid down at the farm. The actual weights were taken as the basis of computation, and the price per pound charged was the average paid for the lambs from Ontario and Prince Edward Island respectively. The cost of shearing was put at 5 cents per animal.

All the food consumed from the time of the arrival of the lambs at the farm until they landed at the Liverpool docks was charged at market values, less the cost of marketing, as previously stated in detail. The cost of growing the rape was put at $8.46 per acre. In Bulletin LX. the cost of growing an acre of rape is put at $11.77. In that estimate however a liberal quantity of manure is supposed to have been used, while in the present instance no manure had been applied to the greater portion of the land for the past six years, and a portion of the rape grown was a catch crop. The basis of computation in both instances is exactly the same. The hay which was the most expensive item of food, was charged at twice the price put upon it in the corresponding experiment of the previous year, owing to the advance in market values. The other food factors were not materially different in price.

The cost of attendance in the corresponding experiment of the previous year was an estimate. In the present instance it is based upon actual experience in caring for the lambs. One man cared for over 600 lambs so long as that number was here on the farm, and about half of his time while thus engaged was spent in work of a purely experimental character. We therefore feel safe in assuming that one man will feed and care for 800 lambs when the food is all prepared. The cost of sending the lambs to England and of selling them there was $357.69 or $3.61 per head, which was 56 cents per head less than in the corresponding experiment of 1891. The following are the items:

Railroad freight charges to Montreal	$61	10
Charges of stock yards	4	91
Wharfage	3	28
Loading on ship	2	25
Caretaker on ship	10	00
Food sent from Guelph	19	98
Hay purchased in Montreal	14	95
One hatchet and one fork	1	15
Expenses Mr. Storey, farm foreman	14	30
Ship's freight and charges including insurance	170	10
Market charges	2	43
Keep and lairage, nights	7	05

Droving	3 03
Dock charges..................................	7 29
Dues and entry	2 06
Gifts	1 21
Commission for selling, 9d. each	18 03
Cash to Mr. Frankland........................	14 57
Total.......................	$357 69

The selling of the lambs in England was purely a commercial transaction and was done on a strictly commercial basis, that is to say, they were sold in the open market and in the ordinary way to the highest bidder.

The autumn shorn wool averaged 3.41 lb. per fleece, unwashed, and sold for 13 cents per pound. The manure made by the 100 lambs was accurately weighed during the continuance of a sub-experiment which lasted for four months. The quantity for the balance of the time was computed from the data thus furnished. The amount made during the four months was 34.867 tons, which would give 69.516 tons as the amount made during the whole period. The average amount therefore made per day by each lamb was 5.81 lb., which on the basis of the valuation given below would be worth .993 of a cent or practically one cent a day. This includes bedding which was not weighed separately. In the corresponding experiment last year the manure was valued at $\frac{3}{4}$ cts. per day per lamb.

Prof. A. E. Shuttleworth, the chemist of the station, made a careful analysis of the manure and handed to us the following report in regard to the analysis, and also to the value of the manure : Organic nitrogen, 12 lb. per ton, worth 17 cents per pound. Total phosphoric acid, 16.8 lb. per ton, worth 3 cents per pound. Muriate of potash, 19.4 lb. per ton, worth $4\frac{1}{2}$ cts. per pound. The commercial value of the manure therefore is $3.42 per ton. By commercial value we mean the value based upon the market prices charged for the three ingredients mentioned when purchased in the form of artificial fertilisers. Since we have stated the amount of the manure made, the reader is given the opportunity of attaching that value to it which may seem proper to him. And here we desire to emphasise the fact, that these lambs were sold in Liverpool at a cash profit as stated below, without taking into account the value of the manure.

The average individual value of the lambs at the commencement of the experiment was......	$3 67
The average price for which they sold in Liverpool.	11 53
The average advance in value therefore was....	7 86
The cash profit which they brought in England without accounting for the manure was....	53 67
Or a cash profit per head of.................	54

The variations in the prices offered for lambs during the past season will be clearly apparent from the following statement :

The price offered per pound live weight for our lambs in Guelph

On December 10th, 1891, was	$4\frac{3}{8}$ cts.
On January 1st, 1892	$5\frac{1}{4}$ cts.

The various lots disposed of brought the prices mentioned on the respective dates given, viz. :

Toward the close of January	$5\frac{1}{2}$	cts.
In February	$5\frac{3}{8}$	"
Early in April	6	"
At Easter	7	"
In England (May)	8.74	"
Equivalent to, in Canada	6	"

The above statement points to the importance of trying to so arrange our plans that we will not of necessity have to sell on a market of slaughter prices. Such a market is manifestly more likely to occur before the holiday season than after it for some years to come, owing to the relatively small number of lambs held over for winter fattening.

CONCLUSIONS.

1. That grade lambs can be purchased in eastern Ontario and Prince Edward Island respectively, shipped westward more than 300 miles in the one case and 1,100 miles in the other, fattened and then disposed of in England at a substantial cash profit.
2. That the average grade lambs of Ontario are well adapted for the above purpose.
3. That lambs shipped to England should sell for an advance of about 2 cents per pound live weight on the prices obtainable in Ontario to secure an equal profit.
4. That lambs may be fattened in winter in considerable numbers with but a small percentage of loss from disease or accident.
5. That grade lambs similar to those fed in this experiment can be fattened in good form in winter, when fed daily the following ration : Grain (oats and peas) and bran in the proportions of 2, 2 and 1–1.06 lb ; roots 2.54 lb. ; and hay 1.27 lb., or a total of 4.87 lb. per day.
6. That the ration given in the above conclusion gave an average daily increase of $\frac{1}{4}$ lb. in live weight.
7. That a ration of rape pasture only, gave a larger increase per day in live weight than the winter ration used in this experiment.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXIX.

EXPERIMENTS WITH WINTER WHEAT.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B.S.A., EXPERIMENTALIST.

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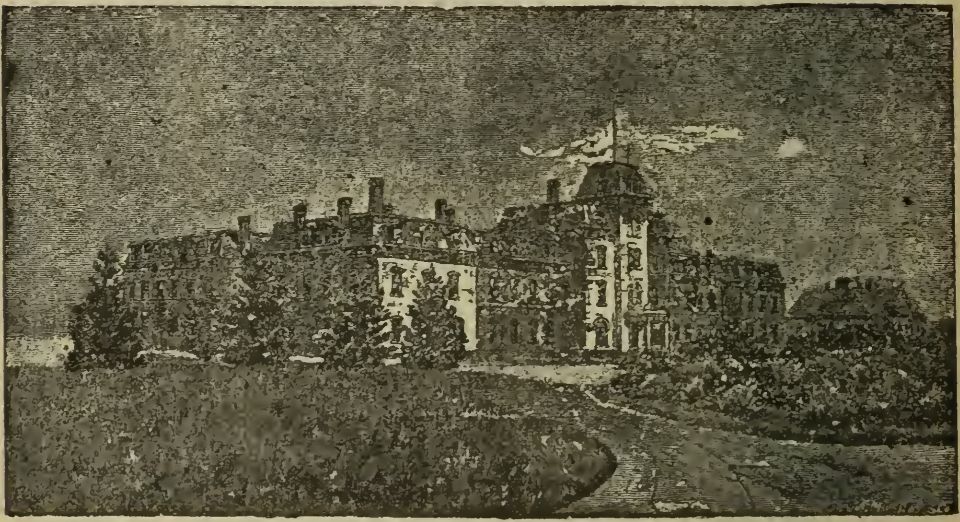

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BULLETIN LXXIX.

EXPERIMENTS WITH WINTER WHEATS.

In growing winter wheat, and indeed any other form of cereal crop, it is highly important that the farmers give much attention to the selection of the more useful varieties. In some seasons this is not so important, as almost any variety will give a fair return, but in others when the conditions of growth and ripening are not so favorable the difference in the yields in some instances amounts to nearly 50 per cent. with varieties grown under the same conditions. As it is impossible to forecast the nature of the season, it is always better to be forearmed by sowing varieties possessed of sufficient vigor and hardihood to enable them to bear up well under adverse conditions.

The qualities to be sought in winter wheat include the following:

1. Ability to give good yields. Occasionally we meet with varieties having nearly all the requisites given below, and yet the yield from them is only ordinary.

2. The quality of the grain, including weight per bushel and value for milling purposes. A variety possessing good milling properties is certainly to be much preferred to one equal in other respects but lacking in these.

3. Strength of straw. This is very important in some seasons, more especially on soils where the grain is liable to lodge, as it bears so directly on the yields and on the labor of harvesting.

4. Non-liability to rust. Although rust is largely dependent on season, soil and location, some varieties have the power of resisting it in a marked degree.

5. Earliness in maturing. This is also intimately associated with yield, as in some seasons an advantage of from three to five days in early ripening will make a great difference in the returns.

6. The presence or absence of beards. Beards are so far objectionable unless there is decided superiority in other directions, as they are less pleasant to handle, they lessen the value of the chaff for feeding purposes and are associated more or less with lack of refinement in quality.

Owing to the low prices ruling for winter wheat there will be an inclination to sow a less acreage this season. This tendency can easily be carried too far. We do well to remember that we have an excellent wheat producing country and that we want large quantities of straw for bedding which cannot be secured so effectually in any other way. There is always less hazard in growing a variety of crops, and it also furnishes a more equable division of the work of the farm. And there is at the same time a possibility of some advance in prices. It is at least questionable as to whether this province should at any time grow less wheat than will suffice for home consumption.

LOCATION AND SOIL. All the varieties of winter wheat, both native and foreign, were grown in plots side by side in the same range. These plots contain each exactly the one-hundredth part of an acre. The yield per acre is estimated from the actual yield of the plots. The aspect of the land is southwesterly, with so little slope, however, that it is almost imperceptible. The soil may be designated as a mild clay loam.

PREPARATION OF THE SOIL. The soil was prepared on the bare fallow system to secure uniformity of condition in a field devoted to the growth of experimental grains. This was the only bare fallow that we had on the farm. The cultivation given was much the same as is usually put upon bare fallows. Barnyard manure was applied at the rate of 15 tons per acre in the spring of 1890 and a crop of rape was grown and pastured off upon the land the same year. No manure has been put upon it since.

SELECTION OF VARIETIES. In selecting varieties to sow those kinds should be preferred which have given the most satisfaction during a term of years rather than for one year. We sometimes find varieties give excellent yields one year which do very poorly the next. We arc now able to give facts relating to the behaviour of a considerable number of varieties for three years as shown in Table II., and these should certainly prove valuable to the farmers of this province engaged in growing winter wheat.

THE VARIETIES GROWN. There were in all 115 plots of winter wheat grown at this station during the present year, including 68 varieties. Of these 35 varieties were grown in duplicate plots; and in another field 8 varieties were grown in plots varying from half an acre to two acres. The larger plots were duplicates of some of the smaller plots, and the particulars relating to them will be given in the annual report. Of the 68 varieties grown, 44 were Canadian and American and 24 were foreign. The foreign varieties which were imported originally from Germany, England, France and Russia in 1889, are all from last year's seed. As none of these kinds have as yet proved equal to some of the best of the Canadian and American varieties and as many of them do not ripen sufficiently early to be reported upon in the bulletin with the latter, we do not feel justified as yet in recommending the farmers to grow them. This bulletin therefore gives the particulars relating to 44 Canadian and American varieties grown under exactly the same conditions.

Table I. gives the characteristics of 44 varieties of winter wheats.

———	Nature of head.	Color of		Date of maturity.	Comparative am't of rust. { 0 none. 100 much. }	Per cent. of straw lodged at harvest.
		Chaff.	Grain.			
1. Surprise	Bald	White	White	July 27	30	10
2. Early Red Clawson	“	Red	Red	“ 26	50	50
3. Rogers	“	White	“	“ 27	25	70
4. Red Velvet Chaff	“	“	“	“ 27	25	70
5. Golden Drop	“	Red	“	“ 26	50	70
6. Bonnell or Landreth	“	White	White	“ 25	20	70
7. Golden Cross or Volunteer	Bearded	Red	Red	“ 26	60	20
8. Manchester	Bald	White	“	“ 27	45	30
9. Standard	“	Red	White	“ 25	45	40
10. Hybrid Mediterranean	Bearded	“	Red	“ 26	40	70
11. Martin Amber	Bald	White	White	“ 27	45	85
12. Seneca or Clawson	“	Red	White	“ 25	30	50
13. Lancaster	Bearded	“	Red	“ 26	45	95
14. Red Lion	“	“	“	“ 26	25	97
15. New Monarch	Bald	White	“	“ 26	50	30
16. American Bronze	“	“	“	“ 28	60	5
17. Egyptian	Bearded	“	“	“ 26	40	60
18. Garfield or Natural Cross	Bald	“	White	“ 26	25	90
19. Jones Winter Fyfe	“	“	Red	“ 26	45	50
20. Bulgarian	Bearded	“	White	“ 26	35	30
21. Winter Pearl	Bald	“	“	“ 28	40	60
22. Canadian Velvet Chaff	“	“	“	“ 26	25	60
23. Democrat	Bearded	“	“	“ 26	25	40
24. Dawson's Golden Chaff	Bald	Red	“	“ 26	80	0
25. Mediterranean	Bearded	White	Red	“ 26	65	90
26. Fulcaster	“	“	“	“ 24	45	60
27. Red Wonder	“	“	“	“ 27	55	95
28. Deitz Longberry	“	“	“	“ 26	55	80
29. Reliable	“	“	“	“ 27	25	10
30. Fultz	Bald	“	“	“ 24	40	10
31. Russian Amber	Bearded	“	“	“ 26	30	40
32. Coryell	Bald	Red	“	“ 24	60	80
33. Rutherford	Bearded	“	“	“ 26	35	90
34. Rumsey	“	White	White	“ 29	25	40
35. Genesee	“	“	“	“ 26	40	50
36. Valley	“	“	Red	“ 26	30	10
37. Walker's Reliable	“	“	“	“ 27	30	50
38. Hybrid Delhi	Bald	“	White	“ 27	20	78
39. Monette	“	“	Red	“ 28	35	50
40. Red Russian	“	Red	“	“ 27	30	20
41. Longberry Red	Bearded	“	“	“ 27	50	80
42. Velvet Chaff	“	“	“	“ 24	40	10
43. Manilla	Bald	White	White	“ 26	40	50
44. Scott	“	“	Red	“ 27	30	10

The extent to which the plots were affected by rust and by weak straw may be noticed at a glance by referring to the two right hand columns respectively of the table, but it should be remembered that these relate only to the present year.

MANNER AND TIME OF SEEDING. The seed was sown by hand as we have no machines suitable for sowing in drills in plots of the size mentioned. The plots were all sown Sept. 2nd, with the exception of Nos. 27, 29, 36 and 40 of Table I. given below., which were sown Sept. 9th, and Nos. 34, 37 and 39, which were sown Sept. 15th. The same amount of seed was sown upon each plot, at the rate of 1⅔ bushels per acre by weight.

THE CONDITIONS OF SEASON AND WEATHER. These were on the whole not so favorable as during the previous wheat year. The weather in the autumn was such that all the Canadian and American varieties made a good growth and they also passed the winter safely. But the months of May and June were abnormally wet, which along with the heavy winds that prevailed caused more or less of lodging in nearly all the varieties. Some of them also rusted considerably. In fact none of them could be said to be entirely free from leaf rust. During the ripening period the temperature was unduly high, but notwithstanding the yields were in many instances fair.

Table II. gives yields of 15 varieties for three years.

Varieties.	Straw per acre (tons).		Weight per measured bushel (lb).		Grain per acre (bush. 60 lb.).	
	1892.	Average 1890-92.	1892	Average 1890-92.	1892.	Average 1890-92.
Surprise	3.43	2.71	59.8	60.6	45.7	46.37
Early Red Clawson	3.22	2.57	59.3	59.9	46.7	45.70
Rodgers	3.23	2.53	60.0	61.1	40.5	43.23
Red Velvet Chaff	3.07	2.49	57.5	60.8	35.8	42.83
Golden Drop	3.46	2.53	62.0	62.1	51.2	42.66
Bonnell or Landreth	3.27	2.76	58.4	60.7	34.3	41.96
Golden Cross or Volunteer	2.83	2.50	61.5	61.3	43.8	41.93
Manchester	3.41	2.47	60.4	62.0	45.4	41.17
Standard	3.44	2.73	57.8	60.2	31.8	40.60
Hybrid Mediterranean	3.53	2.72	61.0	61.8	45.5	40.53
Martin Amber	3.18	2.65	60.2	61.2	37.3	40.07
Seneca or Clawson	3.45	2.76	58.8	60.2	34.0	39.43
Lancaster	3.61	2.86	61.5	62.6	41.3	39.13
Red Lion	3.96	2.81	61.1	61.7	41.2	38.30
New Monarch	3.27	2.49	61.5	60.6	41.1	33.97

As the facts given in Table II. relate not only to results of this year's crop, but also to the average obtained for the past three years they may be regarded as of special importance. The average yield of grain per acre of these 15 varieties was 30.9 bush. in 1890; 51.6 bush. in 1891, and 41 bush. in 1892. For the three years the average was 41.19 bush. The average weight per bush. in 1890 was 60 lb.; in 1891, 63.3 lb.; in 1892, 60 lb. For the three years the average was 61.1 lb. The Surprise heads the list in point of yield, averaging 46.37 bush. per acre for the three years. It is possessed of many good qualities, as ability to yield well, good strength of straw, freedom from rust and good milling properties. The Early Red Clawson follows closely with an average yield of 45.70 bush. Its earliness of ripening is a strong point in its favor. The Rodgers which comes third on the list does not stand high as to milling properties. The Manchester which yields well in some localities, has not done so well with us, as it is somewhat prone to rust. The Red Lion, which several years ago was sold in some localities for $15 per bush. is very weak in the straw. It weighs well, and this is the best feature about it.

Table III. gives yields of 8 varieties for two years.

Varieties.	Straw per acre (tons).		Weight per measured bushel (lb).		Grain per acre (bush. 60 lb.).	
	1892.	Average 1891-2.	1892.	Average 1891-2.	1892.	Average 1891-2.
American Bronze	3.38	2.77	59.3	61.1	39.8	52.5
Egyptian	3.32	2.63	61.5	62.7	47.5	50.4
Garfield or Natural Cross	2.87	2.69	59.3	60.6	32.5	48.4
Jones' Winter Fyfe	2.54	2.15	59.2	61.7	37.8	47.1
Bulgarian	3.08	2 34	61.6	63.0	47.7	47.0
Winter Pearl	2.84	2.67	60.5	60.7	36.1	45.8
Canadian Velvet Chaff	2.98	2.40	55.4	58.8	30.7	45.3
Democrat	3.18	2.43	62.0	63.2	47.2	44.4

These varieties have been grown here for but two years, and like those of the previous table under the same conditions. The average yield obtained from them in 1891 was 55.3 bush. per acre; in 1892, 39.9 bush.; for the two years 47.6 bush. The average weight per bush. in 1891 was 63.2 lb.; in 1892, 59.9 lb.; for the two years 61.5 lb. The American Bronze which stands first in point of yield for the two years did not give nearly so good a return comparatively this year as last. Although it stood up well, it was considerably affected with rust. The Egyptian, though an old variety, has done well, and it will also be observed that it weighs well. The Garfield coming third in point of yield betrayed considerable weakness of straw, while the plots on either side of it stood up well. Jones' Winter Fyfe although possessed of first-class milling properties is only medium as to yield and weight of grain. The Bulgarian which bears considerable resemblance to the Democrat yields fairly and weighs well. It seems to be a rugged wheat and is possessed of good milling properties. The Canadian Velvet Chaff has done rather poorly with us this year. The yield of grain was comparatively low, and it was notably deficient in weight.

Table IV. gives yields of 21 varieties for one year.

Varieties.	Straw per acre. (tons).	Weight per measured bushel (lb.).	Grain per acre. (bu. 60 lb.)
Dawsons Golden Chaff	3.46	59.5	51.2
Mediterranean	3.42	61.8	50.9
Fulcaster	3.23	64.5	50.5
Red Wonder	4.18	62.8	48.8
Deitz Longberry	3.34	61.9	48.7
Reliable	3.14	62.2	47.9
Fultz	3.12	62.5	47.5
Russian Amber	3.20	61.5	46.7
Coryell	2.86	61.5	46.2
Rutherford	3.61	59.8	46.2
Rumsey	3.35	61.5	45.1
Genesee	3.43	61.0	43.8
Valley	2.59	61.5	43.7
Walker's Reliable	2.66	60.4	42.9
Hybrid Delhi	2.86	59.5	42.8
Monette	3.34	59.0	42.1
Red Russian	3.16	61.4	41.4
Longberry Red	3.34	61.0	41.2
Velvet Chaff	2.98	63.0	40.5
Manilla	3.59	58.7	38.6
Scott	2.70	61.0	32.5

The 21 varieties in Table IV. were grown here this year for the first time in these comparative tests and considerably more than one-half the number were imported from the United States. The average yield per acre is 44.74 bush., and the average weight per measured bush. 61.3 lb. The yield of straw per acre is abnormally large, being 3.2 tons per acre, which is probably 50 per cent. more than in ordinary seasons. Weighing the straw at a later date would doubtless cause some reduction. The Dawson's Golden Chaff originated in 1881 by Robert Dawson of Paris, Ont., comes first in point of yield. The wheat stood up better than any other variety but it was affected considerably by rust which no doubt affected the quality of the grain.

The old Mediterranean, imported from the United States, comes second in point of yield showing that it still retains its old-time vitality. The Fulcaster, also from the United States, gave the remarkable weight of 64.5 lb. to the bush. The Red Wonder came out well but is very weak in the straw. It would probably do well on sharp, sandy land. The Scott, so popular at one time, seemed to be lacking in vitality and stands at the foot of the list in point of yield.

Table v. gives comparative summary of results.

——	Number of varieties.	Average yield of straw per acre. (tons.)	Average weight per measured bushel (lb.).	Average yield of grain per acre (bush. 60 lb.).
Bald	24	3.29	59 61	40.15
Bearded	20	3.17	61.64	45.53
White Chaff	30	3.17	60.55	42.30
Red Chaff	14	3.35	60.65	43.51
White Wheat	15	3.23	59.60	39.92
Red Wheat	29	3.23	61.08	43.97

It will be observed here that generally speaking the bearded red chaff red wheats gave more straw and more grain per acre and also gave grain weighing more per bush. than the bald white chaff white wheats. There is very little difference in the relative quantities of straw produced. In weight of grain the average difference in favor of the bearded varieties as compared with the bald is 2.03 lb. In 1891 the difference, 1.37 lb., is also in favor of the bearded sorts. The red wheats outweigh the white varieties by 1.48 lb. per bush. In 1891 the difference in the same direction was 1.96 lb. In 1892 the bearded varieties gave an average yield of 5 bush. per acre more than the bald, while in 1891 the bald varieties yielded 9.9 bush. per acre more on an average than the bearded. The present season, the red wheats yielded 4 bush. per acre more than the white, while last season the white wheats yielded over 5 bush. more than the red. In Bulletin LXVII. issued on winter wheats in 1891, it is stated "that when wheat is grown under favorable conditions the bald varieties yield considerably more than the bearded." To this we may add that from the results obtained this year it would seem to be true that in seasons when the conditions are not really favorable the bearded varieties will yield more than the bald.

DISTRIBUTION OF SEED.

As we have a limited quantity of seed for distribution we append the following in reference thereto:—We will supply any of the following varieties, viz: American Bronze, Jones' Winter Fyfe, Early Red Clawson and Bulgarian in lots of one and two bushels. As the quantity of each variety is limited we can only agree to furnish seed while the supply lasts and in the order in which we receive the applications. The prices charged will be moderate. For further information apply to the Professor of Agriculture, Guelph, Ont.

Some of the varieties will be distributed in smaller lots through the medium of the Ontario Agricultural and Experimental Union. This Union which meets annually at the Agricultural College is composed of the officers, ex-students and students of the College, and all farmers throughout the province are invited to co-operate in the work that is being carried on by the Association. This work consists of the testing of seeds and fertilisers under conditions as nearly similar as may be found practicable. The seeds are furnished by the Union free to farmers and full instructions regarding the mode of conducting the tests are also furnished at the same time. The only return asked of the farmer is a report of the results to be sent after harvest by a time fixed upon as mentioned in the instruction sheet. These reports are made upon blank forms furnished to each experimenter along with the instructions. At the present time there are no less than 5,088 plots under experiment in this province conducted by ex-students and other farmers, the results of which are published annually, and cannot fail to be of much service to the agriculturist.

In the subjoined table will be found the different sets of varieties of wheats which will be sent by mail in half-pound lots of each variety to farmers applying for them and in the order of the application so long as the supply lasts.

Three sets of Fall Wheat for Co-operative Tests.

(1.)	(2).	(3).
Dawson's Golden Chaff.	Dawson's Golden Chaff.	Dawson's Golden Chaff.
American Bronze.	American Bronze.	American Bronze.
Early Red Clawson.	Fulcaster.	Jones' Winter Fyfe.
Bulgarian.	Red Wonder.	Fultz.
Mediterranean.	Surprise.	Golden Drop.

Each farmer wishing one of these sets will please address the Secretary, C. A. Zavitz, Experiment Station, Guelph, *mentioning which set he desires*, when the grain with instructions for testing, and blank forms on which to report, will be forwarded free of cost to his address.

CONCLUSIONS.

The results of the experiments may be thus summarised :

1. That the average yields per acre of the 44 Canadian and American varieties grown in 1892 were : straw 3.2 tons, grain 42.6 bush. per acre and weight per bush. 60.5 lb.

2 That as the averages obtained from the 15 varieties grown at this station for three years were 30 9 bush. in 1890 ; 51.6 bush. in 1891, and 41.6 bush. in 1892, while the average weight per bush. in these respective years was 60, 63.3 and 60 lb., we are justified in concluding that the wheat producing capabilities of Ontario are still of a high order.

3. The four best yielding varieties in 1892, all of which gave more than 50 bush. per acre, are Dawson's Golden Chaff, Golden Drop, Mediterranean and Fulcaster, named in the order of the yields which they made.

4. The four varieties giving the heaviest weights per bush. in 1892 were the Fulcaster, 64.5 lb. ; Velvet Chaff (bearded), 63 lb. ; Red Wonder, 62.8 lb. and Fultz, 62.5 lb.

5. The four best yielding white wheats in 1892, were Dawson's Golden Chaff, Bulgarian, Democrat and Surprise, and the four best yielding varieties of red wheat were the Golden Drop, Mediterranean, Fulcaster and Red Wonder, in the order named in both instances.

6. That the bald Velvet Chaff varieties gave an average of 7.8 bush. less per acre than the mean average of the 44 varieties grown in 1892 and weighed 3.1 lb. less per bush.

7. That in our experience of the past three years the average yields per acre of the white and red wheats have not been far different, being about one bushel per acre in favor of the white wheats.

8. That in our experience of the past three years we have found that the red wheats average from 1 to 2 lb. more per bush. than the white wheats.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXX.

EFFECT OF FOOD ON MILK AND BUTTER.

BY H. H. DEAN, B.S.A., PROFESSOR OF DAIRY HUSBANDRY.

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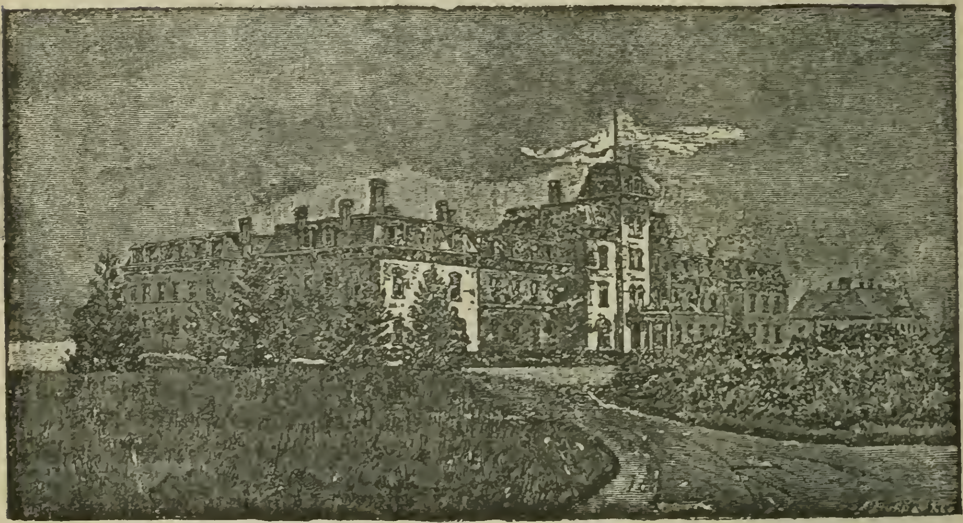

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BULLETIN LXXX.

EFFECT OF FOOD ON MILK AND BUTTER.

During 1891 we conducted an experiment similar to the one here reported.

The cows used in the experiment were six in number, divided into three lots—two cows in each lot. The general plan was to feed each lot for four weeks on one ration, note the quantity and quality of the milk and butter, then change to another ration and feed for four weeks until each lot had been fed each ration for the same length of time. The rations were :

No. 1. Ensilage, 30 lb. ; oat straw, 20 lb. ; hay (cut), 10 lb.

No. 2. Hay (cut), 20 lb.; linseed oil meal, 4 lb. ; cottonseed meal, 5 lb.

No. 3. Hay (cut), 20 lb. ; pea meal, 4 lb. ; oatmeal, 5 lb. ; corn meal, 8 lb.

The effect on the fat and solids not fat was as follows :

The average per cent. of fat given in the milk by the three lots when fed ration No. 1 was 3.67 ; on No. 2, 3.49 ; and on No. 3, 3.25.

The average per cent. of solids not fat from all the lots when fed on No. 1 was 7.79 ; on No. 2 8.62 ; and on No. 3 it was 8.37.

In every case there was a slight decrease in per cent. of solids not fat when the cows were fed the poor ration.

Some conclusions from the experiment of 1891 :

1. When there is a deficiency of fat or albuminoids in the ration, the animal draws from her own body to make up this lack, maintaining about the same *quality* of milk, though the quantity may be greatly reduced.

2. When an excess of nutrients is fed these are doubtless wasted to a considerable extent, and if fed for a length of time might do injury to the animals, though these cows ate their full ration for a period of 21 days without apparent injury.

3. Judging from the returns from the winter ration we may expect to receive profit from a much wider ratio and on less nutrients than the German standard calls for.

4. In answer to the question, Was the fat fed in the food recovered in the milk ? these experiments show that on ration No. 1 more fat was recovered in the milk than was fed in the food, and on Nos. 2 and 3 the returns of fat in milk were about the same as the fat fed, but whether it all came from the fat of the food or not was undecided.

5. The general conclusion would seem to be, that *the food does not affect the quality of milk to any appreciable extent so long as the animals are in good condition.* This applies more particularly to rations fed for short periods—from 21 to 28 days—but in the case of Lot III it may be said to be true for 49 days.

6. It is a waste of food to give more than the animal can assimilate. Find the capacity of the cow for economic production and feed to that capacity.

7. A poor ration may give profitable returns for a while, but will end in depletion of the cow's vitality and injure milk secretion.

8. The cost of food fed is an important item in the profitable returns from a dairy, and an extra amount of some cheap food in the ration, such as ensilage or bran may prove a profitable investment. For instance in the case of Lot I, by putting 20 lb. straw in the place of 6 lb. hay and 5 lb. bran, and reducing the ensilage from 50 lb. to 30 lb. per day, we reduced the cost of the weekly food from $1.78 to $1.22, but we also decreased the value of their production in butter-fat (besides loss of skim-milk) from $3.98 to $2.31; in other words by reducing the cost of the food 32 per cent., the value of fat was reduced 42 per cent., besides causing the cows to lose in weight. (For details of this experiment see College Report for 1891.)

EXPERIMENT OF 1892. This experiment was conducted somewhat differently from that of last year. The number of cows was the same but they were divided into two groups instead of three, and two rations only were used. The experiment lasted from April 4th to June 12th, a period of ten weeks. The cows used were H. No. 2, A. No. 3, and No. 13 in Lot I. A. No. 2, No. 4 and No. 2 comprised Lot II. The rations were: No. 1, 50 lb. ensilage, 1 lb. bran, 5 lb. hay (uncut). No 2, 50 lb. ensilage, 5 lb. pea meal, 3 lb. oatmeal, 2 lb. barley meal, 5 lb. hay (uncut).

No. 1 ration cost 6.35 cents per day and No. 2 15.83 cents.

Lot I was fed for five weeks on ration No. 1, then changed to ration No. 2, which was fed to them for five weeks. Lot II commenced on ration No. 2 and were then changed to ration No. 1. They were fed on each ration for five weeks. The milk from each cow was weighed morning and evening. The per cent. of fat, water and solids not fat in the milk of each cow was determined on four days of each week. On two days of each week the milk from each lot was set in the Cooley creamer. The skim-milk was tested; the cream from each lot was churned separately; the butter-milk was tested; the quality of the butter was noted and a sample sent to the laboratory for analysis, determination of melting point and Iodine number. The cows were weighed at the beginning and close of each period of feeding.

Table showing effect on quality with lot I (3 cows.):

Week ending—	Average p. c. fat.	Average p. c. solids not fat.	Average p. c. total solids.	Weekly lb. fat.	lb. butter in two days.	lb. milk for one lb. butter.	Ration.
April 17....	3.50	8.90	12.40	21.21	5.0	23.0	No. 1. 50 lb. ensilage; 5 lb. hay (uncut); 1 lb. bran.
" 24....	3.34	8.71	12.05	20.74	6.1	25.2	
May 1....	3.31	8.77	12.08	19.73	4.1	27.8	
" 8....	3.36	8.65	12.01	18.85	5.5	26.7	
Averages.	3.38	8.76	12.14	20.13	5.2	25.7	
May 22....	3.10	8.85	11.95	20.00	....	....	No. 2. 50 lb. ensilage; 5 lb. pea meal; 3 lb. oat meal; 2 lb. barley meal; 5 lb. hay (uncut).
" 29....	3.31	8.90	12.21	20.65	5.5	28.9	
June 5.. .	3.37	8.86	12.23	20.08	4.9	25.1	
" 12....	3.43	8.81	12.24	20.03	6.9	21.9	
Averages.	3.30	8.86	12.16	20.19	5.8	25.3	

Table showing effect on quality with lot II (3 cows):

Week ending—	Average p. c. fat.	Average p. c. solids not fat.	Average p. c. total solids.	Weekly lb. fat.	lb. butter in two days.	lb. milk for one lb. butter.	Ration.
April 17....	3.69	9.20	12.89	18.84	4.0	26.3	No. 2. 50 lb. ensilage; 5 lb. pea meal; 3 lb. oatmeal; 2 lb. barley meal; 5 lb. hay (uncut).
" 24....	3.63	9.20	12.83	18.36	5.6	23.9	
May 1....	3.65	9.29	12.94	17.54	5.3	24.3	
" 8....	3.65	9.12	12.77	17.42	5.4	25.7	
Averages.	3.66	9.20	12.86	18.04	5.1	25.1	
May 22....	3.71	8.76	12.47	13.69	....	....	No. 1. 50 lb. ensilage; 1 lb. bran; 5 lb. hay.
" 29....	3.81	8.89	12.70	11.66	2.9	24.8	
June 5....	4.00	8.20	12.20	11.48	3.6	24.7	
" 12*...	....	....	....	......	....	....	
Averages.	3.84	8.62	12.46	12.28	3.3	24.8	

* A. 2 was sick during the latter part of the third week of this period, and hence the results are not reported for the last week. The average per cent. of fat for this week from cow No. 2 was 4.30, and from No. 4 was 4.08. For the last week of period I. the average per cent. of fat from the same cows was respectively 3.67 and 3.77. The average per cent. of total solids from these two cows during the last week of period I, on the rich ration was 12.88, and during the second period on the poor ration, the average was 12.33.

Conclusions as to Quality.

1. The average of four weeks on a poor ration with Lot I was 3.38 per cent. of fat. With one week intervening, during which time they were changed to a rich ration containing the same amount

of coarse fodder but having 10 lb. meal in addition, the average per cent. of fat in the milk from the same cows for four weeks was 3.30—practically the same as in the previous period. Lot II gave milk containing 3.66 per cent. of fat during the period on which they were fed the meal ration, and 3.84 per cent. of fat while receiving practically no meal for three weeks. Again we must conclude that for a short period of time with these cows meal did not affect the per cent. of fat or quality of the milk to any great extent.

2. Last year the poor ration gave results which showed a slight decrease in per cent. of solids not fat. The same is true for this year. The average of both Lots is 8.69 per cent. on the poor ration and 9.03 on the meal ration.

Table showing effect on quantity :

Date.	Total lb. of milk given.	+ Gain or — loss	Weight of cows at beginning of period.	Weight of cows at close of period.	+ Gain or — loss	Ration.
Lot I.						
April 11—May 8....	2,384	......	3,265	3,068	—197	Ensilage and hay.
May 16 -June 12 ...	2,450	+66	3,068	3,114	+ 46	Ensilage, hay and meal.
Lot II.						
April 11—May 1 ...	1,486	......	2,918	2,967	+ 49	Ensilage, meal and hay.
*May 16—June 5 ...	962	—524	†1,941	†1,770	†—171	Ensilage and hay.

* One cow sick for two days in this period. † Two cows only.

Conclusions as to Quantity.

1. With Lot I the extra amount of meal did not appear to have much effect on the quantity, as they gave but 66 lb. more milk in four weeks while getting meal than during the same length of time without meal. This may be accounted for in some degree by the fact that two of the cows in this lot had calved recently. Those in Lot II had been milking for a longer time when the experiment commenced.

2. Both Lots lost heavily in weight while getting ration No. 1, and gained considerably on the ensilage, meal and hay. One ration was not sufficient to sustain the live weight of the animals while giving milk, and the other caused them to lay on flesh without a corresponding increase of milk.

3. The cost per 100 lb. of milk from both Lots on ration No. 1 was 55.8 cents, while the cost when No. 2 was fed was $1.18 per 100. Such a large quantity of meal could not be profitably fed to these cows.

Losses of fat in skim-milk and buttermilk :

Number of trials.		Average p.c. fat in skim-milk.	Average p.c. fat in buttermilk.	Ration.
Lot I.	4.....	0.26	0. 1	Ensilage and hay.
	3.....	0.33	0. 1	Ensilage, hay and meal.
Lot II	4.....	0.72	0.19	Ensilage, hay and meal.
	3. ...	0.48	0.15	Ensilage and hay.

Both Lots appear to have given slightly better creaming results on the ration composed nearly altogether of ensilage. The average per cent. of fat in the skim-milk from both, in seven settings being 0.37 of one per cent., while the average of the same number of settings, under exactly the same conditions, was 0.53, when the meal ration was fed in addition to the ensilage.

Analysis of butter :

Lot.	Ration.	Water.	Fat.	Casein.	Ash.	Iodine number.	Melting point.
I	No. 1—1st period..........	*9.36	87.06	0.99	2.59	32.00	32.25
II	No. 2—1st period..........	*9.74	86.49	1.04	2.74	28.32	34.15
I	No. 2—2nd period.........	*11.36	85.20	1.06	2.38	30.52	32.61
II	No. 1—2nd period....	†11.90	84.78	1.01	2.31	33.32	33.33
	Average on Ration No. 1..	10.63	85.92	1.00	2.45	32.66	32.79
	Average on Ration No. 2..	10.80	85.85	1.05	2.56	29.42	33.38

* Average of four analyses and determinations.
† “ three “ “

It was observed in the practical handling of the samples, that the butter from Lot II was always firmer than that from Lot I, due doubtless to the influence of the animals composing this lot. It is rather remarkable what a difference one or two degrees in the melting point makes in the physical properties of butter. Both lots gave firmer butter or butter with a higher melting point when they were fed meals in addition to the ensilage and hay. Last year when the cows were fed ensilage chiefly it produced a butter with a low melting point (31.75°). “Taking the average melting point (32.4°) of the butter produced from the ensilage, hay, straw, and grass rations as a standard, we find that it was increased 2.3°C. when a mixture of oil meals and hay was fed ; 1° when linseed meal alone was fed ; and 4.1° on the cottonseed meal ration." If it is possible to feed something which will produce firmer butter, a butter that will "stand up" better in hot weather, the question becomes of much practical importance.

There appears to be little difference in the average composition of the butter produced by the two rations. I repeat what was stated in the last College Report, p. 169 : "That the varying per cent. of fat, water and other substances found in butter, is likely due more to the method of manufacture than to the influence of food."

Practical Points for Farmers.

1. For practical use I would not recommend either of the rations used in this experiment. No. 1 I consider deficient in milk producing substances, and No. 2 is too rich for our ordinary cows, as they did not appear to be able to digest and assimilate so much meal. I would also warn against feeding much more than 50 lb. ensilage per day to cows weighing under 1,000 lb. We have found the following ration to give good results : 50 lb. of corn ensilage, 6 lb. of hay, 4 lb. of bran, and 2 lb. of pea and oatmeal mixed in equal proportions. If these latter become too high priced, I would recommend the use of 2 lb. of cottonseed meal (in place of the bran or meals) per day to each cow, when it can be bought for about $30 per ton.

Feed *liberally*, though not wastefully, bearing in mind that although the *per cent.* of fat may not be increased by liberal feeding, the total amount of fat or butter may be largely increased by causing the cow to give a larger *quantity of milk.* Three things determine the value of a cow : *the quality of her milk, the quantity she gives,* and *the economical use she makes of her food.*

2. During the hot weather buttermakers are frequently troubled with soft butter. This is largely due, in most cases, to improper handling of the milk, cream and butter, but there is a tendency during hot spells for the butter to be soft no matter what the care taken. From the experiments here reported I am led to believe that the addition of a small quantity of meal, especially cottonseed meal, has a tendency to make the butter firmer, or as we say, raise the melting point from one to four degrees Centigrade. Last summer we fed about 1 lb. per day to each cow, while at pasture, and our buttermaker informs me that he did not have a churning of soft butter during the whole season. Whether this was due altogether to the cottonseed meal, I am not prepared to say, but I think it had something to do with it. In feeding cottonseed meal it should be mixed with bran, cut hay, or some grain meal.

BULLETIN LXXXI.

BEES IN RELATION TO FRUIT.

By J. H. Panton, M.A., Prof. of Biology, Ontario Agricultural College.

An Act passed by the Ontario Legislature last session, referring to the prevention of spraying fruit trees while in bloom, has led to considerable discussion among fruit-growers and bee-keepers. The former feel that they should be permitted to spray whenever they desire, claiming that bees are not killed from visiting sprayed trees in search of nectar and that this cry of alarm raised by bee-keepers is unfounded. Further, many are under the impression that bees injure ripe fruit, and that it is questionable whether bees are as useful in the fertilisation of flowers as is claimed for them by their admirers.

The bee-keepers, on the other hand, maintain that bees are important in the fertilisation of flowers and thus become necessary to fruit production; that they do not injure fruit and that they are killed where trees are sprayed while in bloom. They go so far as to say that honey is affected where bees have been poisoned by Paris green.

In this somewhat confused state of affairs a bulletin bearing upon bees in relation to fruit should be of interest and practical benefit when the following Act (*passed April, 1892*) is about to be enforced:

1. No person in spraying or sprinkling fruit trees during the period within which such trees are in full bloom shall use or cause to be used any mixture containing Paris green or any other poisonous substance injurious to bees.

2. Any person contravening the provisions of this Act, shall on summary conviction thereof before a justice of the peace, be subject to a penalty of not less than $1.00 or more than $5.00 with or without costs of prosecution, and in case of a fine or a fine and costs being awarded, and of the same not being upon conviction forthwith paid, the justice may commit the offender to the common gaol, there to be imprisoned for any term not exceeding thirty days unless the fine and costs are sooner paid.

3. This Act shall not come into force until the first day of January, 1893.

BEES IN RELATION TO FERTILISATION. During the process of fertilisation the contents of the pollen grains become mingled with those of the ovules, after which the latter develop into seeds. This takes place somewhat as follows: The dust-like substance (pollen) on the ends of the stamens falls upon the top of the pistil. The outer coat of the pollen grain bursts and the inner pushes out in the form of a tube, which forces its way from the top of the pistil down through it until it reaches the ovary (the lower and enlarged part of the pistil) where the ovules are located. In the meantime a minute structure (germinal vesicle) has formed in the ovule. This point is reached by the pollen tube, an interchange of elements takes place, the ovule is fertilised and at once changes begin which end in the complete development of a seed.

The question naturally arises, How do the pollen grains get to the pistil? This effected, fertilisation will in all likelihood take place.

Observation shows that this may be done in several ways.

1. *By the wind.* Where this is the usual way we find the plants are rich in pollen, have no nectar, grow crowded together, in some cases bloom before the leaves appear and are seldom attractive in appearance. The grasses, willows and some maples afford examples of plants largely dependent upon the wind for the transport of the pollen to the pistil.

2. *By artificial means.* Man can effect the same result by simply taking the pollen and placing it upon the pistil. This has enabled him to cross-breed and hybridise to such an extent that he has developed innumerable varieties of plants of great economic value, as is exemplified in our beautiful flowers and luscious fruits.

3. *By birds*, which to some extent aid in carrying pollen from plant to plant, especially such as the humming birds.

4. *By insects.* This probably is by far the most common method in nature, and may be viewed as the chief use of insects.

Plants fertilised by insects present an attractive appearance, are rich in perfume, and above all supply nectar to the insects which frequent them. It can be readily seen how insects moving about in a flower will become loaded with the dust-like pollen, and in passing to other flowers aid much in transferring the pollen from one plant to another, and thus bring about a cross-fertilisation, or in other words, cross-breeding, which seems as essential to the production of vigorous and fertile plants as it does in animal life.

Among insects which aid largely in this interesting process no class is more useful than bees. Where imperfect fertilisation has taken place fruit is incompletely developed in size and form, so that the quantity and quality are affected. Careful investigation has shown that the fruitfulness of many plants is largely influenced by bees and such insects as search for the nectar and pollen of flowers.

Although many flowers have both stamens and pistils in the same flower, still scientific observation has shown that even in these cross-fertilisation is favored by the structure of the flower. From observations made it is claimed that orchards with bee-hives in them have been more fruitful than those without hives. In some cases bees have been given access to greenhouses so that the flowers might be fertilised and thus develop more and better fruit under such conditions. Flowers have been covered so as to prevent insects reaching them, but light and air admitted. Side by side were others to which bees had access. An examination of the seed showed those of the former to be weak in vitality, those of the latter strong. In many instances it has been observed where fruit trees were covered with bloom and poor results followed, that the weather at the time of bloom was cloudy, wet and cold and thus unfavorable to bees working among the flowers.

Scientific investigation indicates more and more as the question of fertilisation is considered, that bees are important factors in the production of fruit and thus become co-workers with fruit-growers.

BEES IN RELATION TO THE DESTRUCTION OF FRUIT. Along this line of investigation exhaustive experiments have been carried on under the direction of the Department of Agriculture, U. S. Neither care nor expense was withheld by the apiculturist to whom the work was intrusted. Hives were kept within a building from which the bees could not escape. In this grapes, peaches, pears and plums, varying from green to dead ripe, were placed. The bees were deprived of food and left with the fruit exposed, so that they might feed upon it when hunger affected them. Many came to the fruit from time to time but never broke the skin, but where they found it broken they at once fed upon the exuding juice. They showed no tendency to use their jaws in cutting open a place. The test was continued for thirty days and other bees tried with similar results. In all cases food was taken only from fruit which had been previously broken. Consequently it appears that bees will not injure perfect fruit, a conclusion arrived at by many observers before these thorough experiments were undertaken. This is what might be expected when the structure of the bee's mouth is considered. It is quite different in the case of wasps which are supplied with jaws suitable to break into the skin, and in all likelihood they are the cause of the injured fruit upon which some observers have seen bees feeding. Much evidence has been collected upon the amount of injury done by bees to fruit, and it all seems to be in favor of exonerating the bee from the charge of injuring sound fruit.

PARIS GREEN IN RELATION TO BEES. In several places where spraying is carried on extensively it has been observed that since the introduction of that practice many bees have perished during the time trees are in bloom, and some observers have noticed that the brood also perished.

Before the days of spraying such mortality was unknown. Now although there has been no analysis of the bodies of the dead bees for the purpose of ascertaining the presence of arsenic, still the death of the bees is so intimately associated with spraying that there seems but little reason to believe otherwise than that the bees have been poisoned by Paris green used in spraying fruit trees. However this will likely soon be settled by an analysis of the bodies of bees supposed to have been poisoned, and I have no doubt arsenic will be detected. I suggest the propriety of bee-keepers forwarding some specimens of poisoned bees to the chemist of the Agricultural College.

Prof. Cook of Michigan has proved by experiment that a solution of Paris green in the proportion of 1 pound to 200 gallons (a common mixture used in spraying trees) proved fatal to bees within 24 hours.

Regarding the effect upon honey there is considerable diversity of opinion. The writer is not aware of any experiments having as yet been undertaken to show that even the honey is affected, though there is in the minds of some very practical men such as the inspector, Mr. McEvoy, who is thoroughly convinced, a great fear that honey produced at the time of spraying is a dangerous article of food. The writer would suggest that some such suspicious honey be sent to the chemist already referred to so that there may be no longer any doubt regarding the subject.

Experiment in the laboratory and observation by practical men indicate that spraying trees in bloom with Paris green is followed by most disastrous results to bees in the neighborhood, and no doubt some degree of injury to the trees as far as fruit is concerned.

The Time to Spray. To spray when trees are in bloom is a great mistake, because it is a waste of material, time and fruit. The plum curculio and codling moth are the chief enemies we seek to destroy with Paris green. The adult of the former lays its eggs in the plum just beneath the skin and is not likely to be present to any great extent till the fruit is *set*, consequently applying the poison while the trees are in bloom is commencing the attack too soon. If thought necessary to attack insects before the time of bloom spraying may be done, and afterwards, but certainly *never while the trees are in flower.*

In the case of the codling moth which deposits its eggs in the blossom end of the young apple, a mistake is also made by spraying before the fruit is set, which does not take place till the bloom is off.

The portion of the pistil upon which the pollen falls is exceedingly tender and sensitive, so much so, that the application of such substances as Paris green injure it to so great an extent that the process of fertilisation is affected and the development of fruit checked. With these facts before us as revealed by scientific investigation, it does seem strange that anyone would attempt to spray at a time not in accord with the teachings of science, and that anyone would feel it a hardship to conform to the requirements of a law calculated to protect the interests of two so important classes as the producers of fruit and honey. Spraying is only in its infancy, but as time rolls on and this practice becomes more general, the practicability of the law referred to will become more evident and the efforts of those seeking to enforce it thoroughly appreciated.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXXII.

CORN ENSILAGE FOR MAKING BEEF

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B.S.A., EXPERIMENTALIST.

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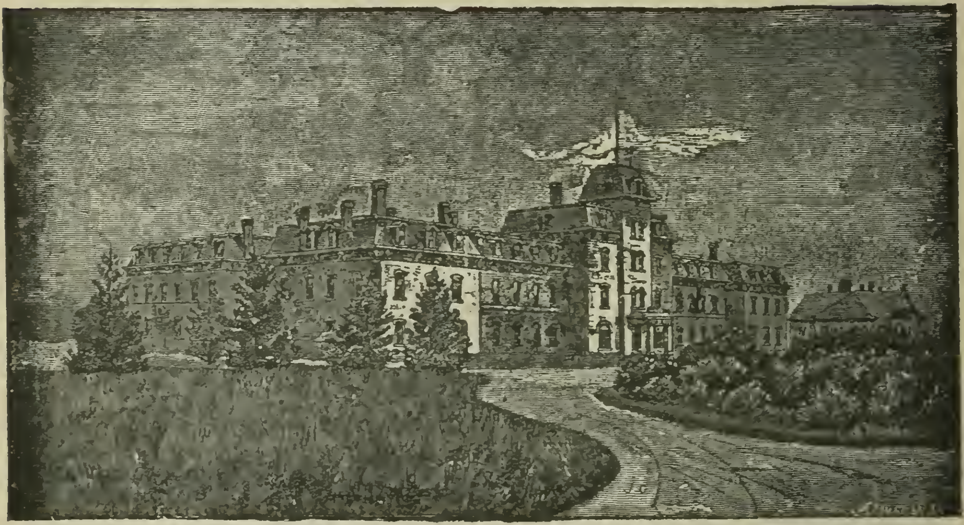

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BULLETIN LXXXII.

CORN ENSILAGE FOR MAKING BEEF.

This experiment began December 16th, 1891, and closed on May 13th, thus covering a period of 150 days. It is the third of a series of experiments conducted at this station having the same objects in view.

The chief objects of the experiment were (1) to ascertain the relative value of the following rations for making beef, viz., ensilage and meal; ensilage, hay and meal; and roots, hay and meal. And (2) to ascertain the cost of making beef when the values of food and meat are both considered. The animals selected were fairly good grade steers in which there was a predominance of shorthorn blood. They were purchased by Mr. J. E. Storey, the farm foreman, and brought to the farm July 25th. They were then put on grass pasture and so kept until October 12th, at which date they were put in the stables. During this period, viz., while they were on pasture, the average gain per day on the whole lot was 1½ pounds.

Period of Preparation. On November 29th six uniform animals were chosen, and divided into three groups, with two animals in each group. They were placed in double stalls, one group in each stall. They were fed for 16 days previous to the commencement of the experiment on the same rations as were given them during its continuance. The object was to accustom them to the new diet.

Food and Feeding. The animals in group 1 were fed all the ensilage they would eat clean. The aim was to give them 10 lb. of meal per day per animal. Those in group 2 were given 30 lb. ensilage per day, the same amount of meal as the animals in group 1, and all the cut hay they would consume. Those in group 3 were given 45 lb. sliced roots per day, the same amount of meal as was given to each of the other groups, and all the cut hay they would consume. The hay was principally timothy, and the roots were turnips and mangels. The meal consisted of equal parts by weight of peas, oats and barley. The foods fed to the respective groups were mixed just before being fed, and were given in three feeds per day. They had salt and water at will.

Food Eaten. One of the animals in group 1 died on January 25th, 40 days after the commencement of the experiment. He was observed off his feed on January 23rd and died two days later. Dr. J. Hugo Reid, of Guelph, was called in the absence of Dr. Grenside. He at once gave it as his opinion that the steer would not recover, and furthermore, that the ensilage fed was concerned in his illness. A *post-mortem* examination was made by Dr. Reid the same day on which the steer died, and the next day, January 26th, he forwarded the following report: "By *post-mortem* held by me on steer that died on this farm yesterday, I wish to state that I found a rupture in the fourth or true digestive stomach, with an escape of a portion of the contents. There was inflammation of the peritoneum and slight inflammation of the small intestines. The rupture of the stomach was caused by gases formed from the food in the stomach, which when fed in large quantity appears to be of an indigestible nature. Death was no doubt caused by said rupture." One of the animals also in group 2 occasionally refused food. For 20 days in succession, in the month of March, he would not eat ensilage, and his gains in consequence were unsatisfactory. Because of these experiences we decided that it would be more satisfactory to use but one animal in each group for purposes of comparison. As we have thus far in this series of experiments used the term group, we shall continue to use it as a matter of convenience, although the reference in future will be to but one animal.

The following amounts of food were consumed daily by each animal:

——	Ensilage.	Roots.	Hay.	Meal.
Group 1	53.5 lb.	...... lb.	..... lb.	9.64 lb.
Group 2	28.39 "	...... "	7.22 "	9.55 "
Group 3	....	41.43 "	10.39 "	9.67 "

Weights of the Animals. Fasted weights were used both at the commencement and the close of the experiment. The fast consisted in withholding food from 6 p.m., after the evening meal had been given, until the animals had been weighed the following morning. Natural weights were taken frequently throughout the experiment, for the reason, among others, that in case of mishap we would have the necessary data for calculations. It may be mentioned here that the average shrinkage in weight from fasting was 42⅔ lb. at the commencement of the experiment and 31 lb. at its close.

Table 1 gives the analysis of weights of the animal in each group:

——	Group 1	Group 2	Group 3
Weight at commencement	1,298 lb.	1,399 lb.	1,364 lb.
Weight at close	1,581 "	1,601 "	1,607 "
Increase per animal	283 "	202 "	243 "
Average daily increase per animal	1.89 "	1.35 "	1.62 "

The animal in No. 1 group made the largest gains, notwithstanding that he was off his feed on two or three different occasions for a short season. That in No. 2 group was also off his feed occasionally, but only for a brief interval at one time. The steer in group 3 had uniformly good health all the time.

The Estimated Value of the Food. The meal, the roots, and the hay were estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. The home value put upon the oats therefore was 26 cents per bush., peas 50 cts., barley 40 cts., roots sliced 6 cts., per bush., and hay, when cut, $9 per ton. Corn ensilage was valued at $1.75, as in the corresponding experiment of last year. The grinding of the grain was put at 6 cts. per 100 lb. The cost of the daily ration given was: To the animal in group 1, 13.07; in group 2, 14.04; and in group 3 17.24 cts.

The ensilage ration therefore was the cheapest of the three. If that were the only consideration, we would have no hesitancy in recommending it before the others, but various weighty considerations claim our attention, such as its effects upon the life of the animals. On the other hand if the cost only were to be considered, we would pronounce against the root ration, but it has important advantages which must not be ignored.

Table 2 gives the financial result of the experiment:

——	Group 1	Group 2	Group 3
	$ c.	$ c.	$ c.
Cost of animals at commencement of test	51 92	55 96	54 56
Cost of food	19 60	21 06	25 86
Cost of attendance....................	3 13	3 13	3 13
Total cost	74 65	80 15	83 55
Value of animals at close of test	92 88	94 06	94 41
Value of manure......................	6 75	6 75	6 75
Total value..............................	99 63	100 81	101 16
Gain per animal	24 98	20 66	17 61

VALUES. At the commencement of the experiment the animals were valued at 4 cts. per lb. live weight, which was the average market price paid for steers of this class at the time. At the close they were sold to go to Great Britain for 5⅞ cts. per lb. on May 18th, 1892, two days after the experiment closed. The cost of attendance was computed on the assumption that one person at $25 per month would feed and care for 40 head under ordinary conditions. This was the estimate used in the corresponding experiment of the previous year.

The manure was estimated at $1.50 per ton, as in the corresponding experiments of the previous years, and the value of the bedding was deducted therefrom as in the experiments referred to.

The total net cash gain on the three animals used in the experiment was $43, equal to a cash gain of 18.04 per cent. on the investment. The total gain on the five animals was $54.75, equal to a cash gain of 13.07 per cent. on the investment. The total loss on the six animals of the experiment, including the dead one, was $7.09. This estimate includes the food eaten by the animal that died, and all other outlay for the six animals and for the food consumed by them, but it does not include the cost of attendance or the value of the manure.

When the manure is included the total gain on the three animals of the experiment was $63.25, on the five animals sold at its close $88.50, and on the six animals $27.32.

The amount received for the three animals of the experiment, when sold on May 18th, was $281.35, which was within 65 cts. of being twice the sum paid for them on July 25th, 1891, when they reached the farm.

Conclusions from the Experiment.

1. That the total cash gain on the investment when the three animals are taken into the account, without including the manure and the cost of attendance, was $43, and the average gain on each animal $14.33. When these items are included the total gain is $63.25, or an average of $21.08 on each animal.

2. That in this experiment the cost of food in making 100 lb. of increase in live weight from the ration of ensilage and meal was $6.93, from that of ensilage, hay and meal $10.43, and from the ration of roots, hay and meal $10.64.

3. That in this experiment an average individual daily gain was made of 1.62 lb. at an average cost of 14.78 cts. for food used.

4. That there is some hazard in feeding a full ration of ensilage to animals that are being fattened when it is fed with meal only.

5. That in this experiment the value of animals for beef purposes was increased by the fattening process an average of 1⅞ cts. per lb. live weight.

6. That while the shrinkage in weight from a 12 hours fast in the stable was 42⅔ lb. per animal at the commencement of the experiment it was but 31 lb. at its close.

Concluions from the three Experiments of 1890, 1891 and 1892.

These conclusions give the results from the three experiments for three consecutive years, and from five animals with the three different rations used.

That the daily average cost of each ration was as follows :

Ensilage, hay and meal	16.78 cts.
Ensilage and meal	16.90 cts.
Roots, hay and meal	19.10 cts.

2. That the average daily increase of live weight from each ration per animal was as follows :

Ensilage and meal	1.88 lb.
Roots, hay and meal	1.74 lb.
Ensilage, hay and meal	1.63 lb.

3 That the average selling price of each animal fed on the different rations, with the cost of food added, exceeded the buying price as stated below :

Ensilage and meal	$12 65
Ensilage, hay and meal	10 95
Roots, hay and meal	8 22

4. That from the behaviour of the animals fed ensilage and meal, we do not consider this ration a perfectly safe one for finishing live stock in beef-making, as out of the six animals fed upon it two died and three were occasionally off their food.

5. That from the behaviour of the animals fed ensilage, hay and meal, we conclude that these food factors form a much safer ration than that of ensilage and meal only, although the animals fed upon it gave some trouble by occasionally refusing to take their food.

6. That from the behaviour of the animals fed roots, hay and meal, we conclude that this ration is a very safe one to use in finishing live stock for beef-making, as the six animals fed upon it had uniformly good health all the time.

7. That steers 1,200 lb. and upwards, standing in the stable during the finishing period, shrink in the neighborhood of 40 lb. per animal with a fast of 12 hours ; that the shrinkage decreases somewhat as the fattening period progresses ; that it is considerably greater when they are at liberty in a yard while being fasted ; and when thus fasted the shrinkage will be less when the animals are given exercise occasionally.

Note. The sources of information from which these conclusions are drawn are Bulletin XLIX., the Annual Report for 1891, p. 106, and the experiment narrated above.

General Observations.

1. The principal object for which these experiments were undertaken has not been completely realised as yet. This object was "to discover the relative value of ensilage and meal; ensilage, hay and meal; and roots, hay and meal in beef-making." As the results have not been uniform, there is necessity for further experiment.

2. Some progress has been made in reference to the solution of the second object of these experiments, viz.: "To ascertain the cost of making beef when the values of food and meat are both considered." These experiments have demonstrated that beef can still be made at a cash profit where suitable grade animals were carefully purchased and judiciously fed, for in these tests we have still a net cash profit of $37.03 when we have thrown the two dead animals into the compost heap. This profit does not include the items of attendance, bedding and manure.

3. These experiments have demonstrated two things, however, and both are important. First, they have made it pretty clear that ensilage and meal only do not furnish a ration that is altogether safe in finishing beef cattle; and second, they have proved in a comparative sense the great safety in feeding a ration of which roots is an important factor. Our advice therefore in the meantime to those who are growing roots for this purpose would be to continue to grow them, and to grow corn in addition where this is practicable.

4. While we have discovered some things from these experiments, there are many things regarding which we have yet to learn. They will be continued, therefore, though in a somewhat modified form. While there are elements of much excellence in ensilage corn for making beef, we are yet in some uncertainty as to the very best way of feeding it. In the hope of securing this information along with other facts that are of much moment, we will continue these investigations.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXXIII.

FEEDING SHORN AND UNSHORN LAMBS IN WINTER

AND

FEEDING LAMBS ON DIFFERENT RATIONS.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B.S.A., EXPERIMENTALIST.

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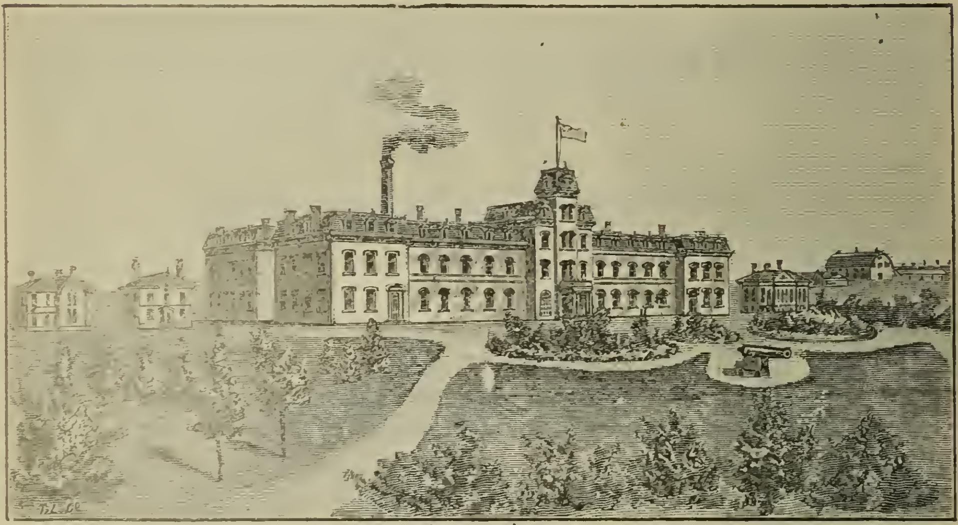

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BULLETIN LXXXIII.

PART I.

FEEDING SHORN AND UNSHORN LAMBS IN WINTER.

This experiment began on December 3rd, 1891, and closed on April 12th following, thus covering a period of 131 days. It is the second of a series of experiments having the same objects in view. The results of the first experiment are given in Bulletin LXVIII, issued in 1891.

The objects of the experiment include the following, viz. : 1. To ascertain whether shorn or unshorn lambs will give the best returns for the food consumed in winter. 2. To ascertain the relative gains that will result from liberal feeding at such a time. 3. To ascertain the cost of feeding lambs for fattening purposes in the winter season on the ration used in this experiment. 4. To ascertain the adaptability of the work to the conditions of Ontario.

The Animals Selected. Twenty lambs were chosen from those obtained in Eastern Ontario, and which reached the farm August 29th, 1891. These lambs are more fully described in Bulletin LXXVII issued earlier in the year. As will be apparent from the weights, these lambs were above the average of the lot from Eastern Ontario, although they were not above the average of the grade lambs of the whole country speaking in a general way. They were of mixed breeding, the blood of the long wools probably being in the ascendant.

Conditions Governing the Experiment. On November 30th, the lambs were divided into two groups of ten each. The fleeces were then removed from those of one group. On December 3rd they were all weighed separately and the experiment commenced. The pens in which they were fed and the yards attached were the same as those used in the corresponding experiment of the previous year, and which are described in Bulletin LXVIII, page 4. The lambs in both groups were given the same kinds and the same quantities of food, except in the item of hay, of which they were given all they would take. They were weighed every month.

Food and Feeding. The food fed to the lambs throughout the experiment consisted of hay, grain, bran and roots. The hay was principally clover, and it was fed uncut. The grain and bran ration was made up of 3 parts oats, 2 parts peas, and 1 part wheat bran by weight. The oats and peas were fed whole. The roots consisted of turnips and mangels fed at different seasons, and they were sliced before being fed. The whole was given in two feeds per day, morning and evening. They had access to water and salt at will.

Estimated Value of the Food. The hay, grain and roots were estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. (See Bulletin LXVIII, p. 5.) The home value put upon the hay therefore was $9 per ton, the oats 26 cts. per bush., the peas 50 cts. per bush , the roots sliced 6 cts. per bush , and the bran was put at $14 per ton. It will also be observed as stated in previous bulletins that in all probability a profit has already been made on the marketable food used, providing it has been grown upon the farm, as in this experiment the food was charged at the full market values less the cost of marketing. This profit will be represented by the difference between the cost of growing the food and the value put upon it.

Food Eaten. The total amount of food eaten by the lambs of each group was the same, except in the case of hay. In each they consumed 1,665 lb. grain and bran, and 6,550 lb. roots. The unshorn lambs consumed 1,832 lb. hay and the shorn lambs 1,885 lb. The amount of food eaten therefore per day by the average lamb was :

Oats	.635 lb.	1.271 lb. grain and bran.
Peas	.424 lb.	
Bran	.212 lb.	
Roots		5.000 lb.
Hay		1.418 lb.
Total		7.689 lb.

The ration was uniform and constant throughout with the exception of the grain portion of it, which was increased at the end of 60 days. All the hay was given to the lambs that they would eat.

In the corresponding experiment of the previous year the average daily consumption of food was 8.81 lb., and with the 100 lambs fed for the British market in the winter of 1891-92, it was but 4.87 lb. The marked difference in the amounts eaten is caused in part by a difference in the size of the lambs, and in part by aiming to finish them quickly in the one case and more leisurely in the other. It will be interesting to compare the results when we get sufficient data from which to draw conclusions safely.

Weights.—The unshorn lambs averaged 104.25 lb. at the commencement of the experiment, and 141.6 lb. at its close. The shorn lambs weighed 101.15 lb. and 132.3 lb. respectively at the corresponding dates. The increase in weight was therefore a little more than 6 lb. in the aggregate in favor of the unshorn lambs. Had they been shorn earlier in the season the results might have been different. In the corresponding experiment which is to follow, the lambs will be shorn at a period considerably earlier.

The average daily gain of each lamb was .262 lb. or a little more than ¼ lb. per day. While these lambs consumed daily 2.82 lb. more of a ration very similar in kind to that fed to the lambs in preparation for the British market, they gained but little more per day. This would seem to intimate that we can easily go too fast in fattening lambs, but there are various considerations to be taken into the reckoning before we draw any hard and fast conclusions.

Table I gives a summary and an analysis of weights.

———	Unshorn.	Shorn.
Weight at commencement	1042.500 lb.	1011.500 lb.
Weight at close	1416.000 "	1323.000 "
Increase per group	373.500 "	311.500 "
Average daily increase per group	2.851 "	2.378 "
Average individual increase	37.350 "	31.150 "
Average individual daily increase	.285 "	.238 "

VALUES. Table II gives the financial results of the experiment.

———	Unshorn lambs.	Shorn lambs.
	$ c.	$ c.
Cost of animals at commencement of the test	52 10	50 55
" shearing	....	50
" food	27 73	27 97
" attendance	1 36	1 36
Total cost	81 19	80 38
Value of animals at close of test	99 12	92 61
" wool	....	5 85
" manure	16 53	16 53
Total value	115 65	114 99
Total gain	34 46	34 61
Gain per cent. on the whole transaction	42 44	43 06

The lambs were valued at 5 cts. per pound live weight at the commencement of the experiment. We received an offer of 4⅜ cts. per pound for all the lambs at that time, but they were put at the price named as they were somewhat superior in quality to the average of the lambs then on hand. The cost of shearing was put at 5 cts. per head. The attendance was reckoned on the basis that one man would care for 800 lambs when the food is all prepared. (See Bulletin LXXVII). At the close of the test the lambs were sold to Mr. L. O. Barber, live stock dealer, Guelph, for 7 cts per pound live weight. They were sent to the Halifax market. The wool from the 10 shorn lambs weighed 45 lb. and was sold at 13 cts. per pound.

The quantity of the manure was estimated from that made by the lambs sent to Britain, and the major portion of which had been weighed. (See Bulletin LXXVIII, p. 14). The estimate was further based on the respective quantities of food consumed daily by the two lots respectively, that is to say, the lambs sent to England and all lambs in this experiment. This gives the output of the manure from the 20 lambs as 12.025 tons, or 9.17 lb. per lamb per day.

Professor A. E. Shuttleworth, the chemist of the station, made a careful analysis of the manure, and handed to us the following report as to the analysis and the commercial value of the ingredients which are chiefly useful in the same: Organic nitrogen, 9.8 lb. per ton, worth 17 cents per pound; total phosphoric acid, 12.6 lb. per ton, worth 3 cents per pound; muriate of potash, 15.0 lb. per ton, worth 4½ cents per pound.

The commercial value of the manure therefore is $2.75 per ton, which would give the value of the amount made per day per lamb as 1¼ cents. A due allowance for bedding however would somewhat lessen the value of the manure. As we have given an approximate estimate of the amount of the manure made, the reader can put that value upon it which may seem best to him.

It will also be observed that there was a net cash gain of $38.73 on the 20 lambs fed, or a gain of $1.94 per head, without including cost of attendance or value of manure.

Conclusions. The following are the chief of the conclusions to be drawn from this experiment:

1. That good grade lambs, when being fattened in winter, may be made to increase .263 lb., or a little more than ¼ lb. per day on a daily ration of 1.271 lb. grain and bran, 5 lb. roots and 1.418 lb. hay, or a total of 7.69 lb.

2. That when the prices of food are as charged in the experiment such lambs can be fattened at a cost for food per day of 2.12 cents.

3. That in this experiment the autumn shearing of the lambs was virtually of no practical material advantage.

4. That where there are facilities for the work, good grade lambs can be fattened in the winter at a substantial cash profit.

PART II.

FEEDING LAMBS ON DIFFERENT RATIONS.

This experiment relates to feeding lambs on three different rations during the winter season. It may be fitly designated an experiment within an experiment, as the lambs used in conducting it were at the same time being fattened for the British market. (See Bulletin LXXVIII.) The 100 lambs used in the experiment were divided into four different groups, with 25 animals in each group. But for reasons to be given below the experiment was confined to three lots.

On December 31st, 1891, they were all weighed and the test commenced the following day. It closed April 30th, thus covering a period of 120 days. The leading object of this sub-experiment was to ascertain the respective values of the various rations used for fattening lambs.

Conditions governing the Experiment. The 100 lambs were so divided that those in each of the four groups were nearly equal in quality. They were then put in the four equal-sized compartments of the same closed shed, the internal divisions of which were made by feeding racks running across the building. The racks were so arranged that the lambs in each compartment could feed on the opposite sides thereof, thus affording them plenty of room for taking their food. The shed is 76 feet long and 28 feet broad outside measure; hence each compartment was virtually 19 feet by 28 feet, from which the room occupied by the feeding racks is to be deducted. The ceiling is 9 feet high, and the food was kept on the loft overhead. Each compartment has a low wide door which was kept open all the time, except in the stormiest weather. The yards in front of the compartments, one for each, extended out about 16 feet from the shed. All the food given them was accurately weighed, and it was given in two feeds daily. They were plentifully supplied with water and salt.

Food and Feeding. The lambs in No. 1 group received a ration consisting of grain, bran, roots and hay. The grain ration consisted of oats, peas and bran fed in the proportions of 2.2 and 1 parts. The roots consisted of turnips and mangels sliced. The hay was principally clover, and it was fed whole. Those in No. 2 group received the same quantity of whole oats by weight as were given in grain and bran to the lambs in group 1, and roots and hay the same in character. The lambs in group 3 were fed mixed grains similar in quantity and quality to those in group 1. In addition they received virtually all the corn ensilage they would eat, and also hay. Those in group 4 were fed grain, bran and roots, the same as the lambs in group 1, and in addition all the pea straw they would take, but as the pea straw proved of much poorer quality than was at first anticipated, the experiment with this lot was abandoned. The same quantity of roots was given to the lambs in groups 1 and 2, and the hay was given without limit in each instance ; that is to say they were given all the hay they would eat clean. The experiment therefore was a test of the comparative value of a mixed grain ration in the one case, as against oats in making mutton, and of the value of ensilage as against roots for the same purpose in the other.

The table gives the comparative cost of the food consumed by the animals of each group, and also of the increase in live weight :

——	Group I.	Group II.	Group III.
Total cost of food per group........	$66.50	$65.94	$60.17
Average cost of food per day per lamb	2.22 cts.	2.20 cts.	2.01 cts.
Total live weight increase per group.	31.46 lb.	33.74 lb.	30.80 lb.
Average weight of increase per lamb per day	.262 lb.	.281 lb.	.257 lb.
Cost of food to produce one pound live weight increase	8.47 cts.	7.93 cts.	7.82 cts.

The good results relatively from feeding the grain ration of oats in the one case, and the ration of corn ensilage in the other, are clearly brought out in the experiment. This is so far satisfactory, as there is no grain so universally grown in Ontario, and corn ensilage can be grown by many who cannot grow roots.

Conclusions.

1. That in this experiment the rations with oats simply made mutton more quickly and more cheaply than the ration with oats, peas and bran.

2. That in this experiment while the ration with ensilage did not make mutton quite so quickly as the corresponding ration with roots, it made it more cheaply.

3. That in this experiment the ration given to the lambs in groups II and III, viz., the oat ration with adjuncts and the ensilage ration with adjuncts proved about equally valuable for fattening lambs, cost considered.

4. That in this experiment an average daily increase per lamb per group of .267 lb. was secured, at a cost for food of 2.14 cents per day ; in other words every pound of mutton added to the live weight cost 8.07 cents, food only considered.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION.

BULLETIN LXXXIV.

EXPERIMENTS WITH SPRING GRAINS

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
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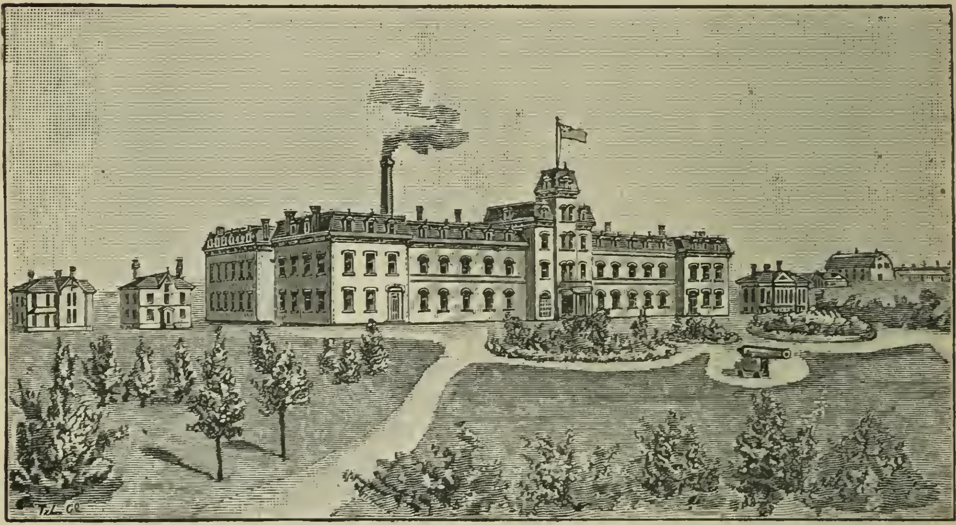

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BULLETIN LXXXIV.

EXPERIMENTS WITH SPRING GRAINS.

(140 Varieties grown side by side for four years.)

The great difference in point of yield of different varieties of grain of the same species has been observed by farmers everywhere. The wisdom of growing only the best varieties at all times will also be generally conceded, and more especially in times when prices rule low and margins are close, will such a line of action be in a sense imperative. In former years the husbandman was restricted in his choice to but few varieties, but now through the work of the Agricultural Experiment Stations, the best varieties that can be obtained are being made easily accessible to every one.

This Bulletin relates to spring grains, foreign and native, grown under similar conditions for the past four years, and it gives important comparisons with reference to them. These comparisons relate, (1) to the yield of grain per acre; (2) weight of grain per measured bushel; (3) weight of straw per acre; (4) date of maturity; (5) strength of straw; (6) length of plant, and (7) color of grain and other peculiarities of growth. Important particulars are also given in reference to results obtained from sowing various kinds of grain at different dates. As rust prevailed to a considerable extent, we have taken it into account when speaking of spring wheat and oats. During 1892, 67 varieties of barley, 63 of spring wheat, 116 of oats and 61 of peas, were grown upon the station grounds and under the same conditions. Full particulars relating to these will be found in the Annual Report. The information contained in the bulletin has been obtained from tests made with 37 varieties of barley, 22 of spring wheat, and 81 of oats. These have been grown side by side for the past .four years and under similar conditions. It also includes the results obtained from 6 leading varieties of peas, out of 20 varieties grown for two years. The plots varied from one fiftieth to one-hundredth of an acre in the different years.

In the tables given below, the yields of grain per acre are estimated from the yields per plot. The standard weight per measured bushel was used with the different classes of grains, and when this bulletin is compared with the corresponding one of last year, viz., LXXI, it will be observed that some varieties in the list for 1891 have dropped out and others have taken their places. It will also be noticed that the remarks on the different varieties vary slightly, owing to a difference in behavior, caused doubtless by variations in soil and climate.

Oats. Table I relates to the ten varieties of oats which have given the highest yields for the four years ending with 1892.

Variety.	Color of grain.	Amount of rust, 1892.	Height of plant, average, 4 years.	Date of maturity, 1892.	Weight per measured bushel, 3 years.	Straw per acre, 4 years.	Grain per acre, bushel 34 lb., 4 years.
			in.	Aug.	lb.	tons	bush.
Joanette Black..	Black ..	None	41.0	7	35.8	2.7	83.0
Chenailles Black	" ..	"	44.0	6	35.8	2.8	79.1
Black Etampes.......	" ..	"	40.8	7	36.4	2.6	79.0
Siberian	White ..	Slight......	54.0	6	36.7	2.5	77.2
Houdan Black... ...	Black ..	None	41.8	6	36.4	2.1	77.1
Danebrog..............	White..	Very slight.	54.8	8	33.7	2.4	75.4
Oderbrucker	" ..	Slight	49.0	7	30.2	2.5	75.1
Improved Besthorne...	" ..	Very slight.	50.3	8	33.5	2.0	74.7
Probsteier.............	" ..	Average....	53.8	8	33.0	2.5	74.5
Pringle's Progress......	" ..	Slight......	47.3	4	30.1	2.3	74.2

The varieties grown in 1889 and 1890 were sown April 22nd, those grown in 1891, April 29th, and those grown in 1892, April 18th. It should be borne in mind that all the leading varieties, except the last mentioned, that is Pringle's Progress, are foreign. They were imported for our station from Europe in 1889. Of the 81 varieties grown during the four years mentioned, 15 only were from a Canadian source, and these include nearly all the old varieties. The Joanette Black, Chenailles Black, Black Etampes and Houdan Black, are very much the same in all essential characteristics. So much so that the three first mentioned appear to be one and the same variety, though probably grown for some time past in different localities in France. These varieties are therefore more suitable for sowing on good rich land. They stand up fairly well, are not coarse, and are almost entirely free from rust tendencies. They are also inclined to shell easily when ripe. The hull is unusually thin, and is easily removed in threshing. The 81 varieties grown for four years gave an average yield in 1892 of 53 bushels per acre. Of these the 10 which gave the highest yields for four years made an average of 76.9 bushels per acre, and the 10 which gave the lowest yields 44.2 bushels. The fourteen best yielding varieties for the four years have all a spreading head. Of the 27 varieties grown for two years only, the Golden Giant and Magnet stand first and second respectively. The former gave an average yield of 89 bushels per acre, and the latter 86.4 bushels. Vick's American Banner came third, with an average yield of 86.3 bushels per acre. Of the 8 newly obtained varieties which have been tested for one year only, the American Beauty stands first. It gave 76.7 bushels per acre.

Spring Wheat. Table II relates to the varieties of spring wheat which have given the highest yields for the four years ending 1892.

Variety.	Seed for 1889, obtained from.	Bearded or bald.	Height of plant, average, 4 years.	Strength of straw, average, 3 years.	Date of maturity.	Weight per measured bushel, 3 years.	Straw per acre, 3 years.	Grain per acre (bush. 60 lb. 4 years.
			in.		Aug	lb.	tons	bush.
Herison Bearded...	France ..	Bearded	40.5	Medium	11	63.5	1.7	26.0
Pringle's Champion	Germany	"	42.2	Medium	11	60.8	1.8	23.6
Saxonka.....	Russia...	"	40.6	Medium	12	60.2	1.5	22 6
Holben's Improved	Germany	Bald ...	41.6	Strong .	16	59.0	1.7	22.0
Bart Trimenia.....	Greece ..	Bearded	38.5	Strong .	13	62.8	1.5	21.8
Summer...........	Germany	"	36.8	Medium	11	57.6	1.6	20.1
Ordinary Bearded March	France ..	"	38.3	Strong .	13	58.1	1.7	20.6
Konisburg.........	Russia...	"	40.5	Strong .	13	62.1	1.5	20.4
Odessa Ghirka.....	Russia...	Bald ...	40.3	Medium	14	59.9	1.6	20.2
Nenhert..........	Germany	"	43.4	Strong .	16	55.0	1.6	18.6

The varieties grown in 1889 were sown April 18th, those in 1890 and 1891, April 25th, and those in 1892, April 23rd. While the Herison Bearded comes first in point of yield, stands fairly stiff in the straw, and has been almost entirely free from rust, the club-shaped heads are somewhat uneven. Pringle's Champion produces a fairly strong straw, has a well shaped head, is not much liable to rust, and produces a fine sample of grain. The 22 varieties grown for four years gave an average of 19.2 bushels per acre in 1892. Of these the 5 which gave the highest yields for four years made an average of 23.2 bushels per acre, and the 5 which gave the lowest yields, 13.1 bushels. Of the 21 varieties grown for three years, the Red Fern comes first. It has given a yield of 31.4 bushels per acre. The White Russian, with a yield of 28.7 bushels, comes second. Of the 10 varieties grown for two years the McCarlin stands first. It has given a yield of 29.7 bushels per acre. The Rio Grande, with a yield of 28.4 bushels, comes second.

Hulless Barley.—Six varieties of Hulless barley have been grown for three years. The average yield per acre for that time has been 38.8 bushels, of 60 pounds per measured bushel, or 44.78 bushels of 48 pounds per bushel. If we compare the three leading varieties with the three best sorts possessed of hull, we find there is an advantage in yield of 1.3 bushels per acre in favor of the former. The average yields respectively, are 54.8 bushels per acre, and 53.5 bushels. The Hungarian, from Hungary, as the name would indicate, stands first on the list, and in several respects it is a very promising variety.

Barley.—Table III relates to the ten varieties of barley which gave the highest yields for the four years ending 1892, and it gives the results obtained from the common six-rowed variety of Ontario.

Variety.	Seed for 1889, obtained from.	No. of rows per head.	Height of plant, average, 4 years.	Strength of straw, average 3 years.	Date of maturity, 1892.	Weight per measured bushel, 3 years.	Straw per acre, 4 years.	Grain per acre bush. (48 lb.) 4 years.
			inch.			lb.	tons	bush.
Mandscheuri.......	Russia ..	6	41.0	Strong..	July 30	50.8	1.8	57.6
French Chevalier..	France ..	2	36.3	Medium	Aug. 3	52.0	1.8	54.0
Empress	England.	2	39.0	Medium	" 7	52.0	2.0	52.8
Scotch Improved...	Ontario..	6	39.0	Medium	July 29	52.3	1.3	51.3
Selected Chevalier.	England.	2	39.5	Weak ..	Aug. 3	51.8	2.0	50.8
Thanet............	"	2	38.5	Weak ..	" 3	52.0	1.9	50.5
Improved Cheyne..	"	2	39.0	Medium	" 3	52.4	2.0	50.3
Oderbrucker.......	Germany	6	38.8	Strong..	July 29	52.9	1.5	49.9
Kalina	Sweden..	2	37.5	Medium	Aug. 3	52.6	1.8	49.9
Hallett's Pedigree .	Germany	2	36.3	Strong..	" 7	52.8	1.7	49 7
Common Ontario, 6-rowed...........	Ontario..	6	36.3	Medium	July 29	53.1	1.3	46.7

The varieties grown in 1889 were sown April 15 ; those in 1890 and 1892, April 19, and those in 1891, April 30. It will be observed that the common Ontario six-rowed barley, so universally grown, has the seventeenth place in the order of yield. Of the eleven varieties grown for two years, the California Brewing stands first, and it also has first place amid the 63 varieties grown in 1892, when it yielded 61.5 bushels per acre. The Kinna-Kulla, a two-rowed variety, imported from Sweden four years ago, and which possesses the property of standing up well in a remarkable degree, is constantly improving in yield, insomuch that in 1892, it gave 58 6 bushels per acre, and stands second in point of yield. The Duch bill, which bears a close resemblance to the Kinna-Rulla, is also stiff in the straw. The yield in 1892 was 47.8 bushels.

Peas.—Table IV relates to the ten varieties of peas which have given the highest yields during the two years 1890 and 1892.

Owing to imperfect germination of the seed in 1891, the results for that year were considered to be incomplete to be of any special value. The varieties grown in 1890 were sown April 24th, and those sown in 1892, April 23. Only two of the imported varieties, viz., the Princess Royal and Early Racehorse, have a prominent place in the list. The Mummy pea, popular in many parts of Ontario, gave an average of 33.7 bushels for the two years mentioned, and an average weight of 63.8 pounds. Of the sixty-one varieties grown in

1892, the Princess Royal gave the largest yield, viz., 46.2 bushels, and the Early Racehorse the heaviest weight per measured bushel, viz., 62.8 pounds.

Variety.	Seed of 1890 obtained from.	Date of maturity.	Weight per measured bushel.	Straw per acre.	Grain per acre.
			lb.	tons.	bush.
Prussian Blue	Ontario	Au. 11	62.7	1.94	43.39
Black Eyed Marrowfat	“	“ 17	61.2	1.66	39.90
Princess Royal	England	“ 15	60.7	1.45	39.15
White Eyed Marrowfat	Ontario	“ 15	62.1	1.32	38.73
Multipliers	“	“ 21	61.8	1.69	37.90
Early Racehorse	England	“ 12	63.5	1.45	35.89

Dates of Seeding.—Table v relates to the average results from seeding oats, spring wheat, barley and peas at different dates in 1891 and 1892.

Dates of Seeding.	Oats.		Spring wheats.		Barleys.		Peas.	
	Weight per measured bushel.	Grain per acre (bu 34 lb).	Weight per measured bushel.	Grain per acre (bu 60 lb).	Weight per measured bushel.	Grain per acre (bu 48 lb).	Weight per measured bushel.	Grain per acre (bu 60 lb).
	lb.	bush.	lb.	bush.	lb.	bush.	lb.	bush.
April 22nd	33.0	52.7	60.7	14.4	48.7	26.1	57.9	19.5
May 1st	31.9	56.9	58.8	12.2	47.0	27.9	59.2	21.1
May 9th	29.2	53.7	56.7	8.6	46.0	27.2	60.7	21.8
May 18th	27.5	41.8	54.2	5.4	42.7	18.3	61.0	18.5
May 26th	24.4	25.3	53.0	3.9	41.9	11.8	61.2	9.7

In every instance, except that of the peas, which were grown only in 1892, and of which but two varieties were used, the figures represent the average of two varieties sown in 1891, and also in 1892, hence they represent the average results of four experiments with the same kinds of grain. It will be observed (1) that oats, spring wheat and barley gave the heaviest weights per measured bushel from the first seeding, and there was a gradual decrease in weight with each successive seeding. With peas the results were exactly the reverse, as the weight of the grain continually increased with each seeding. (2) That while in the case of spring wheat, the highest yields were obtained from the first seeding, in that of oats and barley these came from the second seeding, and in that of peas from the third seeding. But when the tests for 1892 only are compared, we find that the best yields obtained in every instance came from the first seeding, except with peas.

Remarks.—The soils where these plots were grown may be termed a mild clay loam, with a somewhat open sub-soil. The field containing the plots grown in 1889 and 1890 was low lying, and that in which the plots were grown in 1891 and 1892 was elevated.

Conclusions.

1. That considerably higher yields may be expected from several of the foreign varieties of oats, than from the old varieties.

2. That of all the varieties of oats grown for four years, the Joanette Black stands first in point of yield among the black varieties and the Siberian among the white varieties.

3. That the Herison Bearded and Pringle's Champion still retain first and second places in point of yield, among all the varieties grown for four years.

4. That fifteen imported varieties of barley have given a larger yield for four years than the common six-rowed variety.

5. That of all the varieties of barley grown for four years, the Mandscheuri and French Chevalier still hold first and second places respectively, in point of yield.

6. That of twenty varieties of peas grown for two years the Prussian Blue stands at the head of the list in point of yield, and of sixty-one varieties grown in 1892, the Princess Royal gave the largest yield per acre, and the Early Racehorse the heaviest weight per measured bushel.

7. That while it is important that cereal spring grains should as a rule be sown as soon as possible after the ground has become sufficiently dry in the spring, it is more important relatively in the case of spring wheat than in that of oats and barley, while no special advantage seems to follow very early the sowing of peas.

Distribution of Seed.—We have a limited quantity of seed for distribution, and will supply any of the following varieties at moderate prices, and in the order in which the applications are received, viz : *Oats*—Joanette Black, Black Etampes, Siberian, Probsteier, Poland White, Improved Waterloo, Bavarian, White Abundance and Golden Giant. *Peas*—Prussian Blue, Tall White Marrowfat, Canada Cluster, Prince Albert and D'Auverne. *Barley*—Mandscheuri and Oderbrucker. Apply to the Professor of Agriculture, Guelph, Ont.

Some of the varieties will be distributed in smaller lots, through the medium of the Ontario Agricultural and Experimental Union. For circulars apply to the Secretary, C. A. Zavitz, Experimental Station, Guelph.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION.

BULLETIN LXXXV.

WEEDS, AND MODES OF DESTROYING THEM.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B.S.A., EXPERIMENTALIST.

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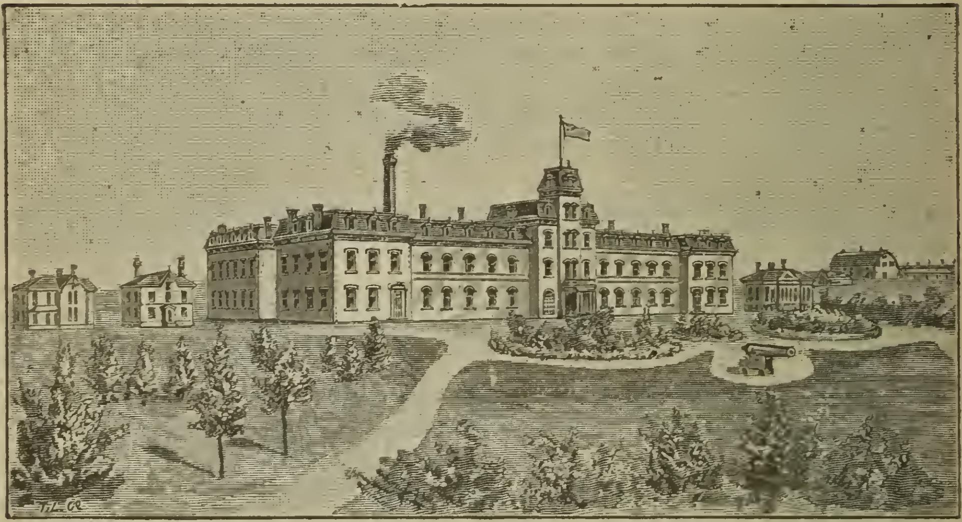

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BULLETIN LXXXV.

WEEDS, AND MODES OF DESTROYING THEM.

That weeds prevail to an alarming extent in the Province of Ontario is patent to every one who has given the subject any attention. That they are on the increase is more than probable. The complete eradication of the more noxious forms of weed life has come to be looked upon as an impossibility by many engaged in tilling the soil, a view which tends to paralyze the efforts that would otherwise be put forth to destroy them. The loss which they cause to the farmers of this province in the large amount of plant food which they take from the soil every year is very great, and the labor expended in efforts to destroy them, often to little purpose, probably represents a still greater loss. Some of them, as the Canada thistle, are pretty generally distributed over the country, and are known to every one, but others, as wild flax, are as yet confined to certain sections, from which they are continually being distributed by the various agencies concerned in their propagation, and frequently they obtain a foothold from which it is difficult to dislodge them, before their presence is known.

Objects of the Bulletin. The chief of the objects of this Bulletin include the following, viz.: 1. To furnish information, through illustrations and otherwise, as to the appearance and habits of growth of the more troublesome forms of weed life which infest this country, that their presence may be at once detected when they are brought into centres where hitherto they have been unknown. 2. To outline certain important general principles that apply, though not always equally, to the destruction of all forms of weed life; and 3. To give specific modes of destroying the more troublesome forms of weed life which infest this province, that are not necessarily costly, and many of which have been proved in our experience at this station.

Possible Achievement. In reference to the destruction of the more noxious weeds, our contention is, first, that the more troublesome forms of weed life can be eradicated on every farm in Ontario, if the farmers decide that so it shall be. Second, that this can be accomplished without heavy outlay when it is done in a certain way.

Third, that when weeds are once eradicated it will be easily possible to keep them so with but little outlay. And, fourth, that the profits will be much larger where the farms are kept free from weeds. When we say that the more troublesome forms of weed life can be eradicated, we mean that they can be removed so completely, that they will cease to interfere with any rotation that may be desired, that they can be completely banished from every farm, except in so far as the seeds are brought again by natural and other agencies, and that when so brought, with the necessary vigilance these in turn can be easily destroyed. That this work can be accomplished without heavy outlay has been fully demonstrated in our experience at this Station, as stated more fully in the Annual Report for 1891, wherein we claim that the whole farm was brought to a clean condition in three years without the loss of a paying crop, and without resorting to the bare fallow, while in a number of instances two crops were grown the same season. The only outlay for which there was no direct return was labor spent in hand pulling and spudding, which in the three years amounted to not more than $250. The assumption that when weeds are once well overcome, it will not be difficult or costly to keep them at bay, is surely reasonable. That they will come again and keep coming is certainly true. But to affirm that it will cost more to keep them wholly at bay than only partially so, as is sometimes done, is certainly illogical. Our experience during the past year has taught us, that a one hundred acre farm when once in a clean condition, may be kept so where the general methods of cultivation are good, without expending a larger sum than $25 per year in spudding and hand pulling. That the profits will be much larger when farms are kept free from weeds is also apparent, since they then use less of the nutriment in the soil that should go to sustain the plants, they injure them less through crowding and overshadowing, and there is certainly less labor involved in subduing them.

Agencies in Weed Distribution. The various agencies by which weeds are distributed are well worthy of attention. Sometimes they are wafted incredibly long distances by the winds of heaven, and are in this way distributed over areas widely separated from one another; at other times they are violently shaken out of the seed pods in which they grow, and driven along over the crusted surface of the snow for miles at a time. Birds carry them to and fro in their innocency in seeking supplies of food for themselves and their young. Sometimes the seeds are carried by wild animals when seeking their winter stores. At other times the seeds are carried in the droppings of domestic animals from field to field, and those which adhere to the coat are in this way carried to other centres. Some varieties are borne down upon us by the floods which swell the watercourses coming down from infested farms; oftentimes we buy them in the seeds we purchase from abroad, and very often they are brought to us by the threshing machine from a neighbor's farm. And yet again we buy them in the manures that we purchase in cities, towns and villages, and in fodder supplies that come from distances more or less remote, while many carry them from field to field in the manure made upon the farm. It should be kept in mind at the same time, that there are but two ways in which weeds may increase through their own inherent powers, viz., by maturing their seeds, and by means of creeping rootstocks which push their way through the soil, and in this way form new plants. Happily these are both under our control, so that where weeds are allowed to multiply, it is because suitable measures are not taken to destroy them.

GENERAL PRINCIPLES TO BE OBSERVED IN DESTROYING WEEDS.

There are certain general principles to be observed in destroying weeds, which will be found very helpful in conjunction with the more specific modes that may be required. These include the following :

1. *Study their habits of growth.* We should not only study the habits of the growth of weeds, but we should adapt our methods of subduing them accordingly. Weeds are classed as *annuals, biennials* and *perennials.* Annuals complete the cycle of their existence in a single year. When annuals are prevented from ripening their seeds upon any farm from year to year, the time must come when that class of weeds will be completely destroyed. They would be destroyed in a single year, but for the fact that many of the seeds, because of the oily coating in which they are encased, have great power to resist the influences of decay, hence they may remain in the soil for years, and yet retain their vitality. The effort then in destroying annuals, should be first, to prevent them from maturing seeds, and second, to adopt such modes of cultivation as will most quickly force them into germination, that they may be destroyed. These modes include autumn cultivation and the growing of root crops. Biennials complete the cycle of their existence in two years. many of them are characterized by a tap root which goes deep into the soil. During the first year large quantities of starch are stored up in the root, and this is utilized during the second year in producing an abundance of seeds. It follows therefore, that any mode of destruction that may be adopted that will prevent this class of weeds from reproducing seeds, will also, in time, effect their destruction. This class of weeds cannot well resist the influence of good cultivation, hence we find them most common in old meadows, pastures, along road-sides, and in by-places generally. In such places persistent cutting must be resorted to.

Perennials live from year to year. Of these there are two classes —the simple, and the creeping perennial. The simple perennial is reproduced from seed only. The ox-eye daisy is a type of this class. The creeping perennial is not only reproduced from seed, but is also propagated by means of rootstocks, which push through the soil. These rootstocks are filled with latent buds, each one of which is capable of sending up a fresh plant under favorable conditions. These favorable conditions are heat and moisture, and a fresh impulse is also given to growth when any disturbing influences, as breaking off from the parent stem through cultivation, is brought to bear upon the roots. Hence it is, that cultivation in moist weather is more likely to promote than to hinder their increase. The Canada thistle furnishes a familiar example of a creeping perennial. In destroying perennials, we must labor to smother them, or to bring the roots to the surface by cultivation, where they will perish by exposure. Any mode of destroying them will be found effective in one season, that will prevent them from breathing through the leaves for several months in the season of growth. But where the attempt is made to destroy them by cultivation which is only partially effective, the residue of the plants left in the land are given exceedingly favorable conditions for development, owing to the loose condition in which the soil is left. Whenever the attempt is made, therefore, to destroy creeping perennials, they should be crushed out, root and branch, in one season. They will come again through seeds that will linger in the soil, but due watchfulness will soon succeed in removing them.

2. *Drop certain crops out of the rotation.* In the war with weeds it is usually greatly advantageous to drop out of the rotation for a time, such crops as allow the weeds which infest them to ripen. Some weeds, as for instance pigeon weed and wild flax, ripen their seeds early, as in winter wheat and hay crops. Others, as ragweed, ripen their seeds late, as in the second cutting of clover. In combatting these various classes of weeds, therefore, the work will be greatly facilitated by dropping the crop out of the rotation for a time in which the weed ripens. As many weeds, however, grow in every variety of crop, this mode is not so applicable to them.

3. *Adopt methods of eradication to conditions of soil and climate.* These conditions have an important influence on the growth of weeds. The Canada thistle for instance, can be destroyed in clay soils with a stiff subsoil, by turning the land into pasture and mowing them twice a year at certain seasons for a limited number of years. On other soils of more open texture, this mode of eradicating them would not succeed.

4. *Allow no seeds to mature.* We should not allow any seeds to mature where it is possible to prevent it. It may be very difficult to accomplish this at first, when we undertake to clean a farm, but generally speaking it may be largely prevented by modifying the rotation for a time. The specific modes of hindering weeds from ripening will vary with the species of the weed, and also with the crop. These will be given in part at least, in a subsequent portion of this Bulletin.

5. *Exercise Care in purchasing Seeds.* The necessity for exercising great care in the purchase of new seeds will be apparent, when we call to mind that it was through this medium that nearly all the foreign weeds came to us that we now possess. They should not only be purchased from reliable seedsmen, but where their presence is detected, they should at all hazards be removed before sowing the grain. They are oftener carried in the seeds of clovers and grasses than in those of cereal grains, hence a particular care should be exercised in the introduction of these.

6. *Give Threshing Machines due Attention.* When these come from farms infested with weeds, they should be thoroughly swept before commencing their work, and also allowed to run for a little time when empty to further clean them. Sometimes it is thought advisable for a number of farmers to protect themselves from invasion, by clubbing together and purchasing machines to do their own threshing.

7. *Give Attention to Screenings from the Fanning Mill.* It may be wise in many instances to burn the chaff and screenings which are of little or no value, that have come from winnowed grain. The inferior portions of the grain, usually termed screenings, may be boiled or ground before being fed.

8. *Grow Hoed Crops as far as practicable.* Hoed crops should be freely grown as far as possible, more especially during the cleaning period. Opportunity is thus given for combatting almost any form of weed life, at almost any period of the growing season. The frequent stirring of the ground is very helpful to the germination of the seeds in the same. Hoed crops are much more effective as aids in destroying weeds when due attention is given to the cultivation as late as this may be done without injury to the crop.

9. *Grow Clover and Lucerne.* Of the different varieties of clover, the common red is decidedly the most useful for purposes of weed destruction. But few kinds of weeds ripen before this variety of clover, and as it may be cut twice in the year, it is specially helpful in the fight with perennials. Its smothering tendencies are no less helpful when it is a good crop. Lucerne is even more valuable than clover for the purpose indicated, as the cuttings of the lucerne are

more frequent than with clover. Sometimes it may be cut as frequently as four times a year, but not always. But it can only be grown on certain kinds of soil, hence its use for the purpose indicated is somewhat circumscribed.

10. *Keep the land Growing Crops* In the conflict with weeds the land should be kept busily at work. With some kinds of soil we can easily get two crops a year, and where this is practised, the process will be found very helpful in destroying weeds. The nature of these crops will depend largely upon climate, soil, and the requirements of the farm.

11. *Stimulate Growth.* Weeds can much more easily be kept in check where the land is stimulated to a vigorous production. When the growth of the crops is strong, more especially early in the season, many forms of weeds are left behind in the race. Growing good crops is another name for good farming, hence good farming is in itself a great hindrance to the multiplication of weeds. The spread of weeds is always much more rapid in impoverished farms.

Growth may be stimulated by improved cultivation, by the application of manures, artificial or homemade, and by growing catch crops for turning under.

12. *Give Attention to Autumn Cultivation.* By autumn cultivation we mean, the tilling of the soil after harvest, with a view to the destroying of weeds. No other mode of destroying weeds will probably be found so efficacious for the outlay as this. As soon as the crops are removed, the land that is not sown to grass should be gang-plowed. All weeds that are then growing above the surface are turned under. The seeds of others lying in the soil are encouraged to germinate, and these in turn are again destroyed by harrowing or cultivating, or by the late autumn plowing that precedes the advent of the winter. Catch crops may sometimes be grown on lands plowed at this season.

13. *Do the Work Thoroughly.* When the eradication of weeds is undertaken, it should be as complete as possible, and done in the shortest possible time. The cheapness of the process is usually in direct proportion, first to its completeness, and second, to the brevity of the period occupied in doing it.

14. *Maintain Cleanliness when Secured.* When cleanliness has been secured, it should be maintained from year to year. To effect this two things at least require to be done. The general management of the farm must be good, that good crops ordinarily may be grown, and every portion of it must be gone over once or twice a year with the spud, except the part devoted to hoed crops. When lands have once been made fairly clean, one person will have no difficulty in going over ten acres a day with the spud, and removing from the same all noxious forms of weed life. We have proved this over and over again in our own experience.

15. *Costly Methods.* Two modes of destroying weeds are frequently adopted which are good in themselves, but which we do not favor, because of their costliness. We refer to the bare fallow process, and to the destroying of the seeds through the fermentation of the manure. Both are very expensive, the former in the labor involved, and the later in the loss of much nitrogen in the manure.

SPECIFIC MODES OF DESTROYING OUR MOST TROUBLESOME WEEDS.

Nearly all the modes of destroying the different weeds treated of under this heading we have proved in our own experience. Sketches of each weed have been prepared from living specimens, which show the habits of root growth as well as of the portion above ground. We shall speak of eleven of the more troublesome weeds that disturb the agriculture of Ontario. These are the Canada Thistle, the Corn Sow Thistle, Couch Grass, the Ox-Eye Daisy, the Burdock, Blueweed, Wild Mustard, Wild Flax, Pigeon weed, Ragweed and the Wild Oat.

The Canada Thistle.

The Canada Thistle (*Cirsium arvense*), is a creeping perennial, which grows to the height of two to four feet, according to the character of the soil. It is so universally known in this country, that nothing more needs to be said in regard to its appearance.

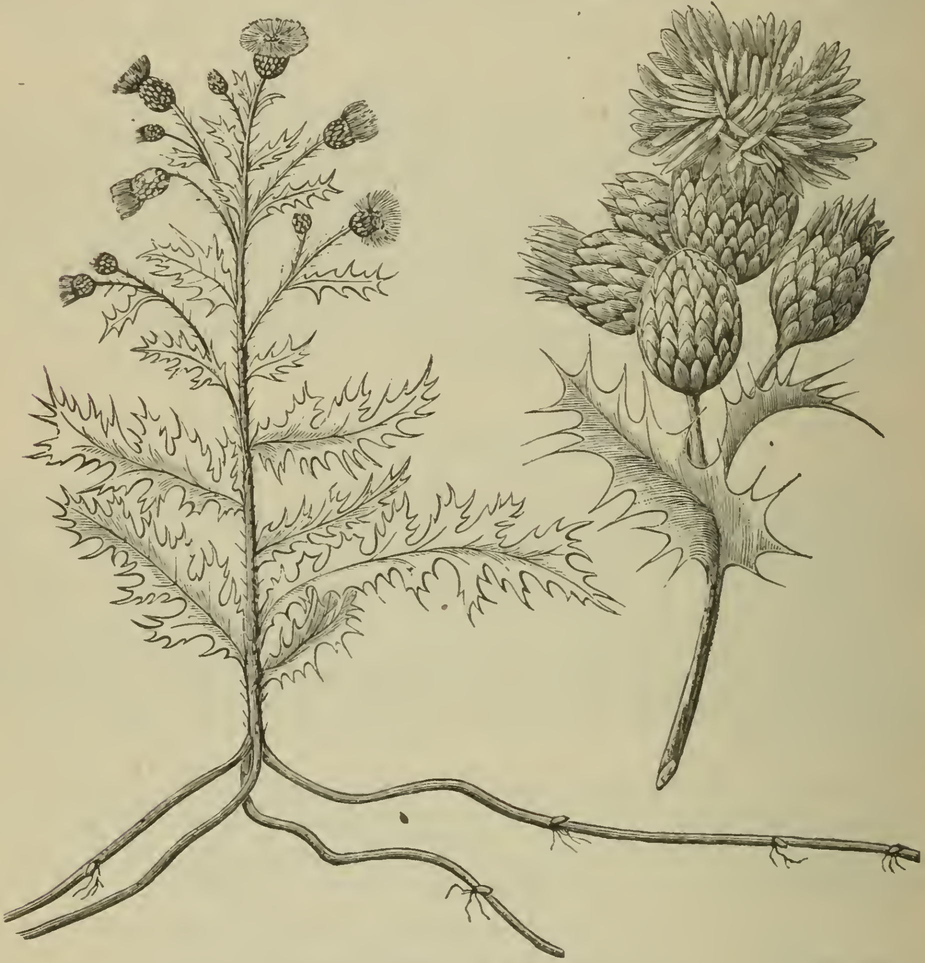
This weed comes up early in May, and continues to grow until the time of severe frost in autumn. It comes into blossom in July and August, and also matures its seed in these months, but more especially in August.

The Canada Thistle will grow in nearly all kinds of soils, but in mucks, with moist bottoms, it does not find a congenial home. It grows amid all kinds of crops, and the seeds ripen along with all the cereal grains, several of the clovers, timothy, and other grasses.

It is propagated by means of the seeds, and also through the medium of rootstocks, more especially the latter. The rootstocks, which penetrate the soil horizontally to great distances, are filled with latent buds, which, when the roots become broken, as by the disturbing influences of cultivation, at once spring into vigorous life. The seeds are not only wafted incredible distances with the wind, but they are also scattered through the medium of the seeds of all kinds of cereal grains and some of the clovers and grasses. They are also carried in the manure, The following are some of the modes of dealing with this intruder:

1. Drop out of the rotation so far as practicable all such crops as allow the thistle seeds to ripen before these are cut, until infested fields have been dealt with.

2. Plow the land immediately after harvest. Plow shallow with any kind of plow that will cut the thistles off clean without breaking off the creeping rootstocks. Keep the thistles from breathing above ground until the late autumn plowing, which should be deep, for the sake of the crop which is to come after. In the spring keep the thistles under by the use of a suitable cultivator, until the time of planting a crop of corn, roots or rape. Give the crop thus planted the horse hoeing necessary to keep down all weed growth, and also keep the thistles cut out of the line of the rows by hand hoeing. Go over the crop if necessary once or twice after the horse cultivation ceases, and there should not be one thistle left. The most effective part of the work has been done the preceding autumn providing the weather at that time has been dry.


Canada Thistle (*Cirsium arvense.*)

3. Plow the ground deeply in August. Sow rye early in September at the rate of 2½ to 3 bush. per acre, and cut the following spring for winter fodder. Then plow the ground deeply with any kind of plow that will effectually bury the stubbles. The jointer with skimmer will answer very well. Then roll at once to conserve the moisture. Harrow once a week until it is time to drill the ground for rape. Drill about the last of June or first of July by using the double mould board plow. The drills may be 22 to 24 inches apart. Sow at once with rape by using the ordinary turnip drill and then cultivate and care for as described in section 2 above. In our experience at this farm we have found this mode of destroying the Canada Thistle to be very effective.

4. Plow under pasture land in June, or land from which a crop of hay has been removed early in July. Work the land thus plowed upon the surface, so that all thistles will be kept under until the time of sowing winter wheat. Sow the wheat with clover and repeat the process if necessary, after having cut one, two or three crops of the clover. This method is applicable to stiff soils, where winter wheat can be grown. In sections where winter wheat will not grow, substitute for it rye, spring wheat or barley, as may be desired.

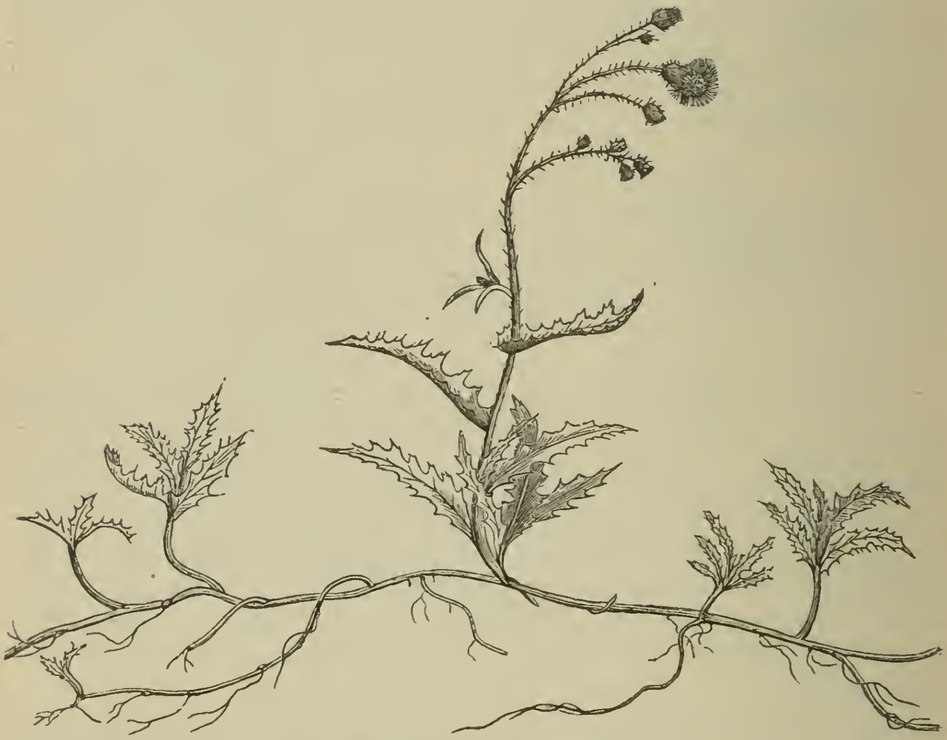
5. Where the land has been sown to clover, cut the crop twice for hay, or once for hay and once for seed. Then follow with a hoed crop properly cultivated. The smothering influences of the two crops of clover in one season, and then two cuttings, are very helpful in reducing the thistle.

6. When the thistles are well brought under they should be kept so by the use of the spud. The grain fields should be gone over before harvest to prevent the thistles from blossoming, and after harvest the meadows and fields sown to grass. So far as the destruction of the thistle is concerned, spudding after the blossoming season is more effective than when this is done sooner. Two or three cuttings with the spud after harvest punish the thistles very badly. We have found that by spudding two or three times a year in the autumn, the thistles soon disappear from the fence borders and bye-places generally.

7. In removing thistles from permanent pastures, we must be governed by the character of the soil and subsoil as to our mode of proceedure. On stiff clays two or three cuttings a year with the scythe or mower for a limited number of years will suffice, but in open subsoils the spud will have to be resorted to. The first cutting however may be done with the scythe, just before the thistles reach the blossoming stage.

The Sow Thistle.

There are several varieties of this weed, some of which do not give serious trouble to cultivation. It is not an easy task to classify the different varieties, but it will be sufficient for our purpose here to confine our remarks to the variety known as the Corn Sow Thistle (*Sonchus arvensis*), which is by far the most troublesome of this family of plants. The Corn Sow Thistle is a creeping perennial. The plant has an upright habit of growth. It grows to the height of one to three feet and sometimes it attains to a greater height when the soil is congenial. Like the Canada Thistle it is somewhat branched toward the top. The stems are rather hairy or bristly, especially the flower stems. The prickles upon the leaves are harmless. The stems are hollow, and when wounded a milky juice exudes from them. The blossoms are yellow and the plants are great producers of seed.



Sow Thistle (*Sonchus oleraceus.*)

The corn sow thistle makes its appearance in May, and continues to grow until autumn. It blossoms in July, and matures its seeds in July, August and September. It will grow in any kind of soil, but is most at home in rich moist loams, and it gives the least trouble in stiff clays.

This weed infests all kinds of crops, and it ripens its seeds somewhat earlier than the crops amid which it grows. The only exceptions probably are red clover and lucerne. It is propagated by means of the seeds which float about in the air, owing to the downy attachment which they possess, and as the seeds are very numerous, they increase very fast in the neighborhood of where they are allowed to ripen. This plant also propagates rapidly by means of its numerous rootstocks, which contain a very large number of buds, as shown in the sketch. The seeds are also conveyed in those of grains and grasses.

The modes of destroying this intruder are essentially the same as those given for the eradication of the Canada thistle.

Couch Grass.

Couch grass (*Triticum repens*) is known by a great variety of names, of which quack grass is the most prominent. It is a creeping perennial, the rootstocks of which are so numerous that they soon fill the soil. They resemble considerably the roots of June grass (*Poa pratense*), but they are much larger and stronger and more vigorous in every way, and they are very much more tenacious of life. The rootstocks are so strong and unyielding, that they have been known to push their way through the tuber of the potato. The stems grow about as high as those of timothy, and each one is terminated by a slender spike or head, from two to several inches long. The leaves bear much resemblance to those of timothy, but are somewhat larger.

Couch grass makes a good growth early in the season, and it also furnishes considerable aftermath. It matures its seeds in August. It will grow in almost any kind of soil, but is much more partial to loams and soils of a decidedly open texture. It is least at home in stiff clays, and in these it is much more easily destroyed.

This weed grows in all kinds of crops from early spring until late autumn, and so long as the period of growth continues, the work of propagation goes on through the medium of the roots. Its power to crowd out other crops where it gets a footing is very great.

Couch grass is propagated through the medium of the seeds as well as through that of the rootstocks. As the seeds ripen along with those of nearly all the cereal grains, it is distributed by means of these, and also through the medium of the seeds of various clovers and grasses. The seeds are also distributed in the manure. When the attempt is made to destroy couch grass, effective work should be made of it in a single season.

The following mode of dealing with it will be found successful, unless in seasons that are unduly moist:

Plow lightly after harvest, then harrow with the ordinary harrow, and if necessary use the spring tooth cultivator to shake the roots of the grass free from the soil. Then draw them into light winrows with the horserake, and when dry enough burn them. If the weather should not be dry enough for this, the rootstocks can be carted into the compost heap. Repeat the process a second time, and even a third time the same autumn if the weather will admit of it, plowing more deeply every time to bring up fresh rootstocks. But in any case do not continue the work in wet weather, else the labor will be lost. When the late autumn arrives, rib the land by turning two furrows together from opposite directions, or plow so that the

Couch Grass (*Triticum repens.*)

largest possible amount of surface will be exposed to the action of the frost in winter. The frost has the effect, first, of killing the roots of the exposed portions, and second, of freeing them from the adherent soil. In the spring, use the harrow and cultivator occasionally in time of dry weather, and in case of need also the horse-rake, until it is time to plant corn, roots or rape.] [Cultivate this hoed crop properly, giving it what hand work may be necessary along the line of the rows, and by the autumn the couch grass should be all gone, unless the season has been a wet one.

In the fence borders it will be difficult to dislodge this grass without removing the fence for a time, and subjecting the ground to a cleaning process by means of cultivation. Another way when it is found in but small patches would be, to pile manure or straw upon it, and leave the same on long enough to smother it.

The Ox-eye Daisy.

The Ox-eye Daisy (*Leucanthemum vulgare*), is a simple perennial, with a branching habit of growth. It grows from one to two feet high, according to soil and crop conditions, but it is usually not more than one foot in height. It produces large flowers, bordered by white rays. The fancied resemblance of the disc in the center to the eye of an ox has probably originated the name.

The ox-eye daisy is a very hardy weed. It commences to blossom early in Jnne, and under some conditions, will blossom as late as September. The seeds possess the power of maturing on the stalk, though the latter be cut before they are quite ripe. Although the plants appear singly at first, if allowed to ripen their seeds, they fall and grow again so thickly, that spudding is impossible, hence in pastures, along road sides, and in bye places where cultivation cannot be introduced, this weed is extremely difficult to eradicate. Live stock will to some extent browse it off when it is young, but they do not relish it, owing to its woody character.

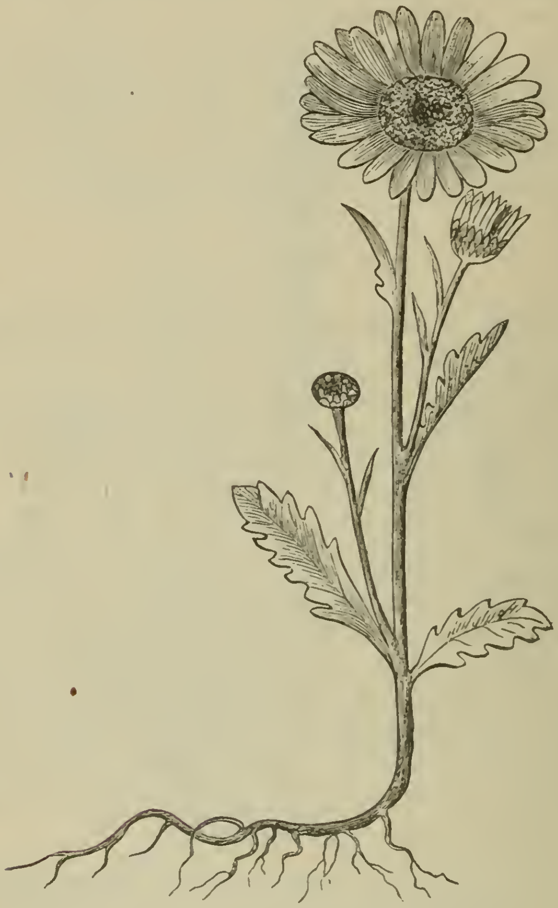
It grows in all soils, but is more vigorous and troublesome in those of loose texture. It infests all kinds of crops, and also road sides and pastures. It is more difficult to dislodge it from meadows than from any of the other crops of cultivated soils, and more especially as they grow older, as the roots of the plants become interlaced. It is least troublesome in hoed crops.

This weed is propagated entirely by means of the seed. It is more commonly brought in the seed of timothy and some kinds of clover, but is also conveyed through the medium of cereal grains. It is often taken from field to field on the farm in the manure, and is carried to some extent by birds.

The following include the principal methods of destroying the ox-eye daisy :

1. Drop meadows out of the rotation until the infested fields have been dealt with. Adopt the same plan with permanent pastures where this may be at all practicable.

2. Grow a crop of rye, followed by rape, as described in section 3, when treating of the modes of destroying the Canada thistle.



Ox-eye Daisy (*Leucanthemum vulgare.*)

3. Pasture meadow land until the middle of June. Then plow deeply, and sow with rape in drills. Cultivate the rape with sufficient care. It may be necessary to follow with a crop of corn or roots.

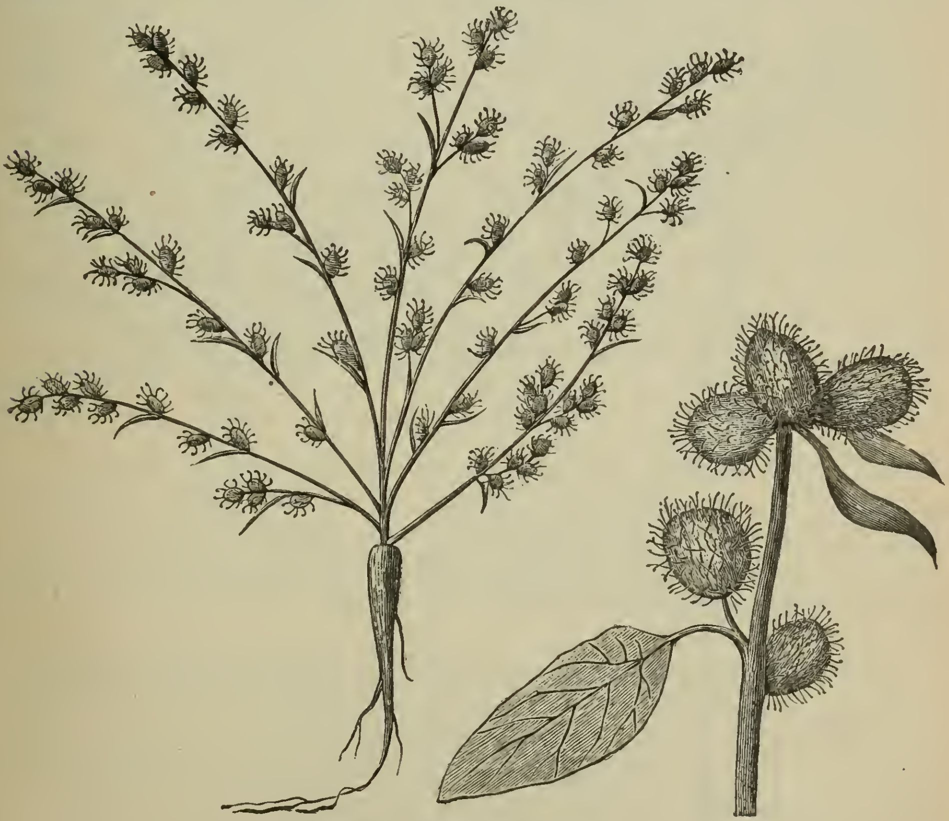
4. Plow lightly after harvest, and then deeply before winter. Give one or more harrowings in the interval before the final late plowing, to destroy weeds that may germinate, and follow with one or two hoed crops well cared for.

5. Sow with rye and pasture until June, or cut for hay. Follow the rye with a crop of millet, or if desired, work the ground on the bare fallow system until winter wheat may be sown in September.

General observations: 1. After cultivation with a view to the destruction of the daisies, the ground should be sown with grass seeds in the crops which come after. These crops should be gone over with the spud, and any daisies found in them destroyed. The same course may be necessary in the meadow which comes later, more especially the first year. 2. In places which cannot be cultivated, and along fence borders, it is difficult to deal with this pest. Any plan that will prevent it from maturing seeds will doubtless prove effectual, but several years would probably be required to eradicate it by this method.

The Burdock.

The burdock (*Lappa major*), is so common, and at the same time so easily managed, if the work of destroying it is gone about properly, that it would seem almost superfluous to write abont the modes that will prove effective in exterminating it. Notwithstanding, it is one of the most universally widespread weeds that we



Burdock (*Lappa officinalis.*)

have. The burdock is so well-known, that we need not dwell upon a description of it. The sketch below illustrates its habits of growth.

As the burdock is a biennial, the first year it does not produce any seeds. It sends a strong tap root down into the soil, hence it is not easily injured by dry weather. It comes into flower chiefly in the months of June and July, but more especially in July. When cut above the crown, even after seed pods are formed, young shoots will be thrown up around the parent stem, and seed matured in some instances within a few inches of the surface of the ground, and long after the usual time for producing seed.

This weed will grow in nearly all soils free from ground water. It is much prone to get a foothold along the fence borders and in bye places of the farm, but does not give very much trouble where the land is well cultivated. It is propagated solely by means of the seed. It is more commonly carried from place to place through the medium of domestic animals, to the hair and wool of which the burs have become attached.

The burdock may be destroyed as follows :

1. In grain and hay fields the reaping or mowing, as the case may be, will prevent the plants from maturing seeds at the usual season. If the fields are gone over later with the spud or some such implement, and the plants are thus cut below the crown, they must die.

2. In bye places as fence sides, lanes, around buildings, and in pastures, they should be destroyed by the use of the spud. The cutting may be done at any time of the year when the ground is not frozen, and will in all cases prove effective in destroying the plants, when they are cut below the crown. Farmers who go over their fields twice a year with the spud, will soon have no burdocks.

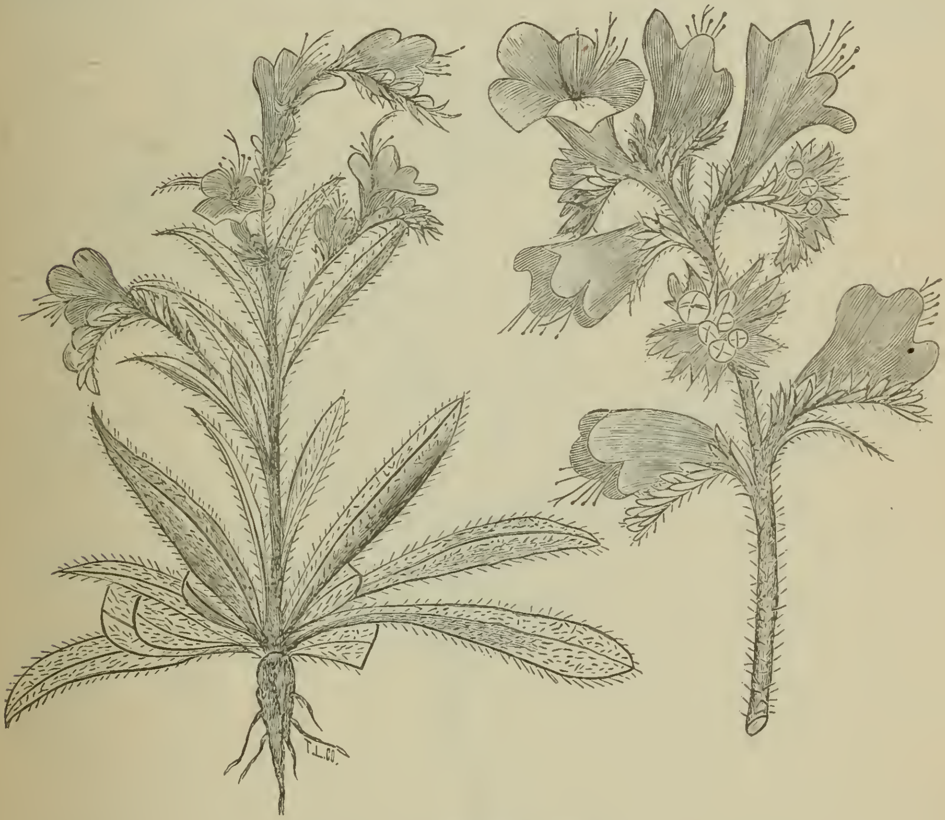
Blue-weed.

Blue-weed (*Echium vulgare*) is a biennial. It is upright and spreading in its habits of growth, as it has several branches, and it grows to the height of one to three feet, according to the character of the soil. The leaves and stems are covered with numerous hairs, which stiffen with the advancing growth of the plant. The blossom is a deep blue.

Blue-weed sends a strong tap root down deep into the ground the first season, and from this branch off several smaller roots. During the second year the strong plants come into bloom in June, and the weaker ones later, hence the period of bloom extends into the closing days of September. When cut off above the surface during the second year, new shoots at once branch out, and some of them hug the ground so closely, that they are not easily cut clean with the scythe or mower.

This weed grows in various kinds of soil, but its favorite feeding grounds are those which contain much lime. It grows vigorously in gravelly soils, even in some of those used in road making. It is not very troublesome in cultivated areas, but along highways and in pastures, and bye places, it is sometimes a great pest.

Blueweed is more commonly propagated through the agency of the winds, which blow the seeds over the crusted snows both far and near, as the seeds frequently remain in the receptacles wherein they grew on into the winter.



Blue-weed (*Echium vulgare.*

The following methods will be found effective in combating this weed :

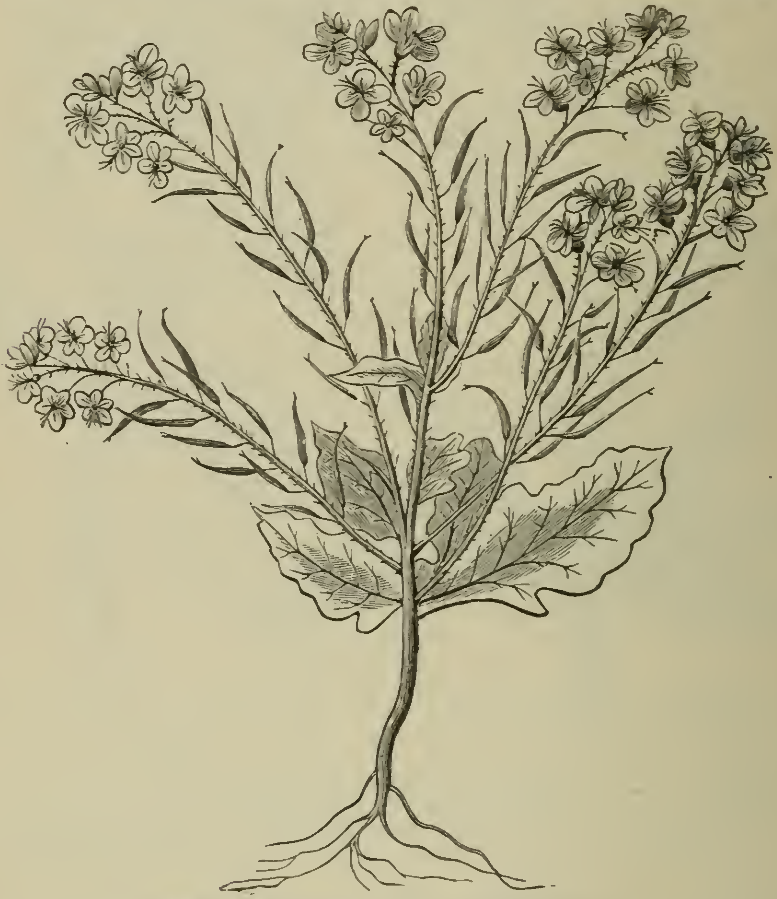
1. Really good cultivation will keep it from getting a foothold to any great extent in cultivated fields. When stray plants put in an appearance, the spud is the most efficient agent in removing them, unless the ground is to be broken up the same season. When cut off at any stage of its growth below the crown the plant must die.

2. In permanent pastures, along roads, and in bye places, any mode of cutting that will prevent the plants from going to seed will remove them in a few years.

3. When fields containing blueweeds are pastured closely during the early part of the season, the growth of seed will be very much hindered. But this agency will not alone suffice to eradicate it.

Wild Mustard.

Wild Mustard (*Sinapis arvensis*), is one of the most difficult of weeds to dislodge where the plants get an extensive foothold. Owing to the extraordinary vitality of the seeds, it requires many years to destroy all the plants, as they continue to come up in the successive crops. This plant is more or less branched, and has a bright yellow blossom, which can be seen long distances away. In the early stages of the growth, the plants resemble those of the radish or fall turnip. The seeds cannot easily be identified from turnip or rape seed.



Wild Mustard (*Brassica Sinapistrum.*)

Wild mustard is an annual. It comes up early in the season and grows rapidly. The seeds continue to germinate as long as the season of growth lasts. It matures an immense number of seeds in pods about an inch in length. The first flowers appear early in June, and the late plants will produce seeds on into September. Usually it is about eighteen inches high, but sometimes it grows considerably higher. As it cannot withstand severe frosts, it is not found to any considerable extent in meadows, or pastures, or winter grains as wheat or rye.

This plant will grow in any kind of land, but not equally well. It is most at home in friable limestone soils, that possess good drainage, but it will also grow in great luxuriance on prairies containing much humus.

It grows vigorously in all kinds of grain crops sown in the spring, and it usually ripens its seeds before the grain is ripe amid which it grows.

Wild mustard is propagated by means of various agencies. Some of the seeds are carried by birds, but usually they find their way to new centres in seed grain. The threshing machine carries them from farm to farm. They are also carried in the droppings of cattle and in the manure.

The following are among the more effective modes of fighting this weed :

1. Drop out of the rotation, as far as possible, the spring crops amid which the mustard grows, until the infested fields have been subjected to a cleaning process. Grow hoed crops at the same time to the greatest extent possible.

2. Grow rye followed by rape, as described in section 3, when speaking of modes of destroying the Canada thistle. Follow the rape with barley or spring wheat sown with grass seeds. If the mustard plants in the spring grain are not too numerous, remove them by hand, otherwise cut the crop for fodder before the mustard is ripe. Where necessary, follow the meadow or pasture as the case may be, with a crop of corn, managed as described in section 3, given below. Spring grains sown with grasses should follow the corn.

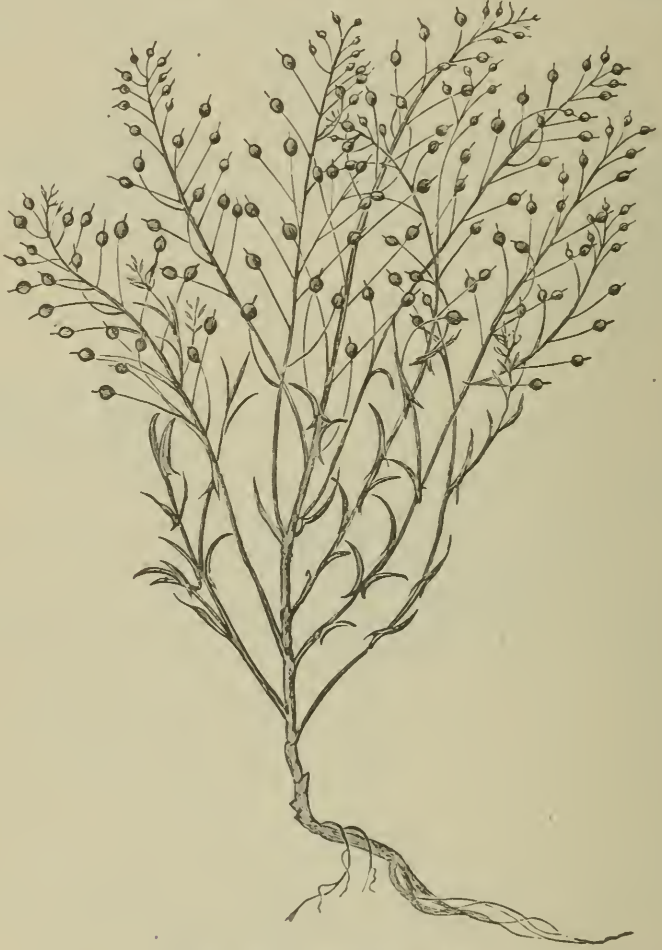
3. Give careful attention to autumn cultivation. This reduces the number of the seeds in the upper layer of the soil. Plow deeply before winter for the sake of the crop that comes after, and to expose another section of the soil. Cultivate carefully in the spring until time to plant corn or to sow rape. Follow the hoed crop with spring grain sown with grasses. If thought necessary, a second hoed crop may follow the first before sowing with grass seeds.

4. Sow with rye in autumn, as described in section 2. Cut the rye for hay or ensilage, or plow it under for a green manure. Then cultivate occasionally after the ground has been plowed until the time for sowing winter wheat or rye. The wheat or rye, as the

case may be, should be sown with grass seeds. The few plants which may grow in the wheat or rye, may be removed by hand. Whatever method may be adopted at first, hand pulling must be resorted to before the work can be completed.

Wild Flax.

Wild Flax (*Camelina sativa*), sometimes known as False Flax, is an annual which usually grows about eighteen inches high, but sometimes it grows considerably higher, and when in thick masses many of the plants attain the height of only a few inches. After the blossoming stage the upper portion of the plant consists mainly of stems and seed pods, as shown in the sketch. The blossoms are small, and of a pale yellow color.



False Flax (*Camelina sativa*)

This plant is very hardy, and can well withstand the influences of frost. It is more inclined to come up in the autumn. The seeds, which are very numerous, are easily shed. They have some resemblance to the seeds of the common flax, but are much smaller. It is a weed that will grow in any kind of soil adapted to the growth of winter wheat or meadows.

Wild flax infests winter wheat, rye, meadows and pastures. It does not usually grow to any considerable extent in spring crops. When thus found the plants may have germinated in the autumn.

This plant is propagated in the seeds of the crops amid which it grows, in the farmyard manure, and also to some extent in the droppings of cattle. But the seeds are carried to a greater extent in timothy seed than in that of any other crop.

The following include the principal modes of destroying it:

1. Modify the rotation by dropping out of it for a time in the infested fields such crops as winter wheat, rye and meadows. Grow spring crops instead. One of those may be a hoed crop.

2. Grow two hoed crops in succession when the other conditions will admit of this.

3. Grow rye followed by a hoed crop; but the rye must not be allowed to ripen.

General observations. 1. In the conflict with this weed grass seeds should invariably be sown along with spring grains, as wheat or barley. 2. Autumn cultivation is all important, owing to the natural tendency of the weed to germinate at that season. 3. When wild flax is found only in certain patches in meadows, the infested parts may be cut and used for soiling purposes. 4. When Lucerne can be substituted for meadow, the first cutting would take place before the flax is ripe.

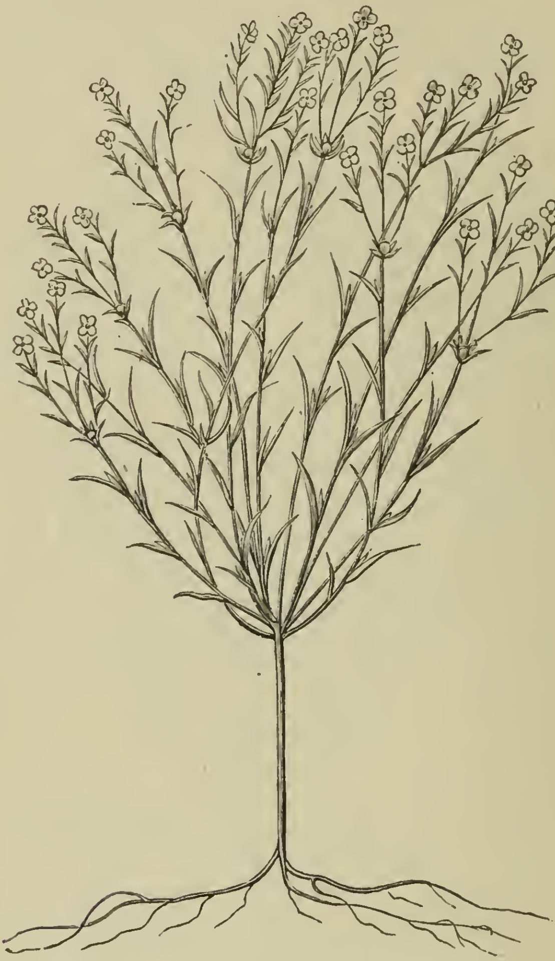
Pigeon Weed.

Pigeon weed (*Lithospermum arvense*), sometimes called Redroot, like wild flax is an annual. It usually grows from eight to sixteen inches high, but sometimes in rich soils it is considerably taller. It is more or less branched in its habits of growth. The leaves have a somewhat lighter tinge than those of cereal grains and grasses. The flowers are small, and of a pale white color. The seeds are abundant. They cluster along the stems, and they are possessed of much vitality.

Pigeon weed, like wild flax, usually comes up in the autumn of the year previous to that in which it matures its seeds. The blossoms appear during the latter part of May and early in June, hence the seeds ripen before our meadows and winter cereals are cut. Its presence is most easily detected just when it is coming into bloom. It will grow in any kind of soil that is dry, but is most partial to sandy loams.

This weed is troublesome only in crops which mature their seeds early, and which have been sown the previous year. These include winter wheat, rye and meadows, and it is also found in pastures.

Pigeon weed is more commonly propagated through the medium of seed grains, as those of wheat and rye, and of grass seeds, as those of timothy, mammoth clover and alsike clover. It is not carried in the seeds of common red clover. Other agencies in this work are birds, quadrupeds, and threshing machines. It is also distributed in the manure.

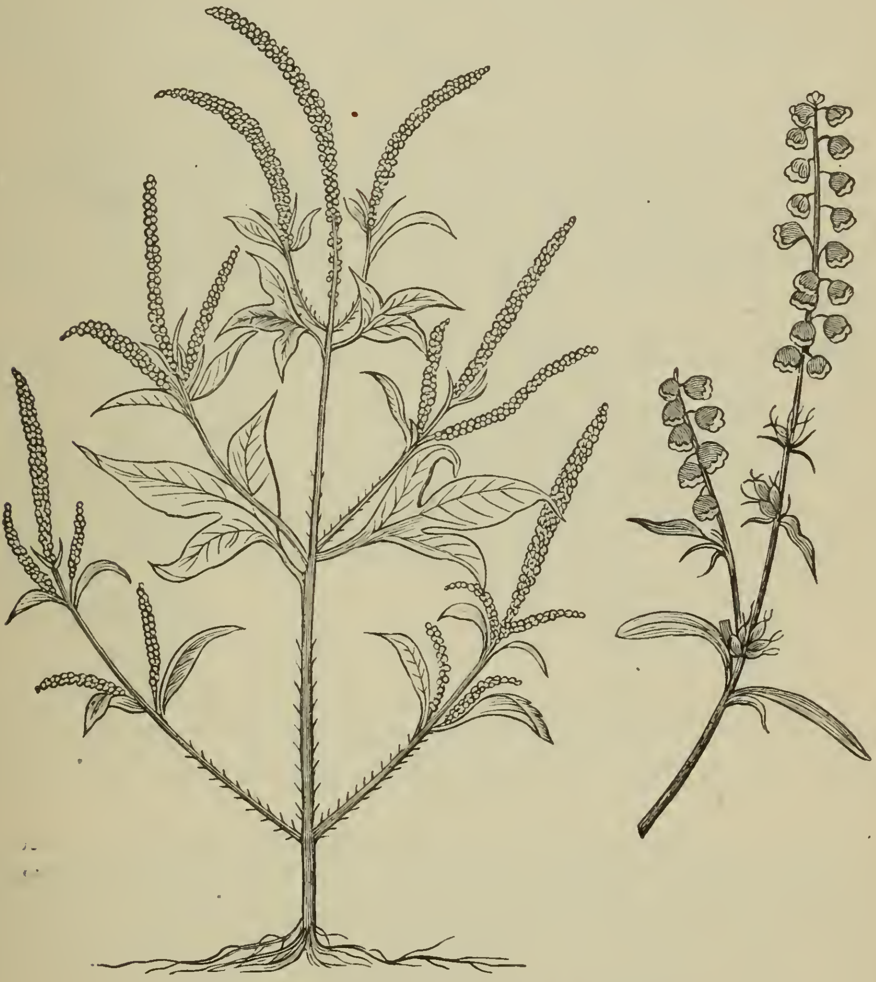


Pigeon Weed (*Lithospermum arvense.*)

The more effective modes of fighting this weed are essentially the same as those given when treating of wild flax, as these two weeds bear much similarity to one another in the crops which they infest, and also in their habits of growth.

Ragweed.

Ragweed (*Ambrosia Artemisoefolia*) is an annual which possesses a slender and much branched stem. There are several varieties, but the one shown in the sketch is by far the most troublesome. It more commonly grows to the height of 15 to 21 inches, though in some soils, under favorable conditions, it will grow to the height of four feet. The leaves are much serrated in the outer edges, hence the name. The blossom has something of a yellowish tinge. The buds are small and round and dark in color when ripe, are very numerous, and are chiefly produced on the outer portion of the branches. They are so light that they float readily in water, and are possessed of great vitality.



Rag Weed (*Ambrosia 'Artemisoefolia.*)

Ragweed grows late rather than early in the season, so much so that it does not usually ripen its seeds in the cereal crops or in meadows before they are reaped. But in the stubbles, of these the plants continue to grow if not disturbed. They blossom from July onward until the time of frost, according to the attendant conditions of growth.

Ragweed will grow in all soils free from stagnant water, but it very much prefers friable and loam soils, containing a large amount of humus. It revels in black loams and mucks, but does not make much headway in stiff clays. It matures its seeds in the stubbles after the crops have been removed, in late grain crops, and in clover cut for seed.

It is propagated in the seeds of late maturing cereals, mammoth and alsike clover, and timothy, but more especially in common red clover. The seeds are also distributed by threshing machines, birds, the domestic animals of the farm, and in manures. But no agent is probably more potent in distributing it than water in time of freshets.

The following include the more effective modes of destroying ragweed :

1. Modify the rotation suitably, and give special attention at the same time to autumn cultivation. As soon as the cereal crops are reaped, the ground should be gang-plowed, or plowed in any way that may be desired. It may then be stirred occasionally before the late fall plowing. Autumn cultivation is particularly helpful in the destruction of ragweed.

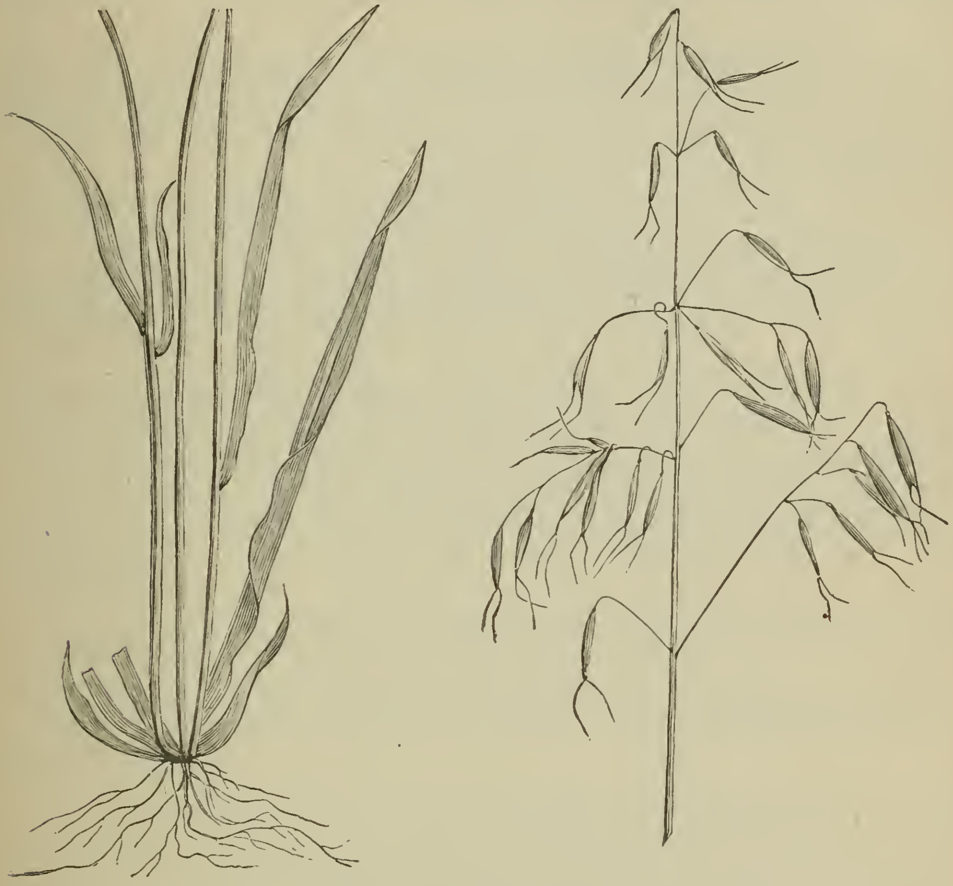
2. Grow hoed crops as described in section 3, when treating of wild mustard.

3. Use the mower in the autumn. This can be done when fields are newly sown with grass seeds. Pastures and meadows may be treated in the same way. This will prevent the seeds from ripening in these.

General observations. 1. When infested meadows or pastures are to be broken up, this may be done, where practicable, before any of the seeds ripen. 2. When the plants are well reduced, hand spudding will soon complete the extermination of this weed. 3. Sheep may be made to render substantial service in cropping this weed while it is yet tender.

The Wild Oat.

The wild oat (*avena fatua*) is an annual. It bears considerable resemblance to the common oat, but there are some distinctive points of difference. In the wild oat the chaff scales which adhere to the grain are thick and hairy, while in the cultivated varieties, they are not so coarse and are hairless. The wild oat has a long, stiff awn, usually twisted near the base; in the cultivated varieties this is entirely wanting, or if present, is not so stiff and is seldom bent. The grain itself is light, being chiefly made up of hull.



Wild Oat (*Avena fatua.*)

This plant matures its seeds in crops of winter wheat, rye and all kinds of spring cereals. It so closely resembles the cereals amid which it grows until the time of coming out in head, that it is practically impossible to remove it by hand before that time, unless when found growing in a crop of peas. It luxuriates in soils well adapted to the growth of cereals, as clay loams, but will grow in nearly all kinds of land. The seed possesses great vitality.

This weed is brought to new centres chiefly through the medium of the seeds of cereal grains, but it also comes down at time of high water from infested fields to lower levels. It is further distributed to some extent in the manure, in the droppings of cattle and through the medium of the threshing machine.

The following modes of combatting the wild oat will be found effective :

1. Grow hay, pasture, fodder crops and hoed crops as much as possible until the oats are much reduced, and drop cereal grains out of the rotation so far as practicable for the time being.

2. Break up sod land in the month of June. Cultivate and harrow occasionally until the time of sowing winter wheat, that the seeds of the oats may be induced to germinate in the upper section of the soil. Sow the wheat with grass seeds, and when the meadow is broken up again repeat the process.

3. Give attention to autumn cultivation, and follow with a hoed crop, as described in section 3, when treating of wild mustard.

4. Grow a crop of rye for fodder, ensilage or pasture, as the case may be, plow the land in June, and manage as described in section 2, above.

5. Cultivate in the autumn, sow early in the spring with oats, peas and vetches, and cut and cure as a fodder crop, and follow this with autumn cultivation, or with a crop of rape grown in drills.

AN ACT TO PREVENT THE SPREAD OF NOXIOUS WEEDS AND DISEASES AFFECTING FRUIT TREES.

R. S. O. 1887, chap. 202, amended by Vic. 53, chap. 59 ; and by Vic. 54, chap. 48,

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows :

1. Where used in this Act the term "non-resident land" shall apply to a lands which are unoccupied, and the owner of which is not resident within the municipality, and the term "resident lands" shall apply to all lands which are occupied or owned by persons resident within the municipality.

2. It shall be the duty of every occupant of land, or, if the land be unoccupied, it shall be the duty of the owner—

(1) To cut down and destroy all Canada thistles, ox-eye daisy, wild oats, ragweed and burdock growing on his land, and all other noxious weeds growing on his land, to which this Act may be extended by by-law of the municipality, so often each and every year as is sufficient to prevent the ripening of their seed, provided that such cutting or destruction does not involve the destruction of the growing grain.

(2) To cut out and burn all the black-knot found on plum or cherry trees on his land so often each year as it shall appear on such trees ; and

(3) To cut down and burn any peach, nectarine or other trees on his land infected with the disease known as the yellows, and to destroy all the fruit of trees so infected.

3.—(1) The council of any city, town, township or incorporated village may, by by-law, extend the operation of this Act to any other weed or weeds, or to any other disease of grain or fruit trees or fruit which they declare to be noxious to husbandry or gardening in the municipality ; and all the provisions of this Act shall apply to such noxious weeds and diseases as if the same were herein enumerated.

(2) Such council may and, upon a petition of fifty or more ratepayers, shall, appoint at least one inspector to enforce the provisions of this Act in the municipality, and fix the amount of remuneration, fees or charges he is to receive for the performance of his duties ; and in case a vacancy shall occur in the office of inspector, it shall be the duty of the council to fill the same forthwith.

(3) The council of any township in which there are any large tracts or blocks of waste or unoccupied land, may upon the petition of not less than thirty ratepayers, by by-law, suspend the operation of this Act, in respect of such waste or unoccupied lands ; the by-law to define with sufficient clearness the tracts or blocks of lands so exempted ; such by-law to remain in force until repealed by such council ; and until repealed the lands therein described shall be exempt from the operation of this Act.

(4) The council may pass a by-law dividing the municipality into such sections or divisions as may be necessary for the carrying out of this Act, and may appoint inspectors for such divisions whose duties and powers shall in all respects be the same as that of the township inspector.

4.—(1) It shall be the duty of the inspector to give or cause to be given notice in writing to the owner or occupant of any land within the municipality whereon the said noxious weeds are growing and in danger of going to seed, (and in the case of property of a railway company, the notice shall be given to any station master of the company resident in or nearest to the municipality), requiring him to cause the same to be cut down or destroyed within ten days from the service of the notice; and it shall be the duty of the inspector to give or cause to be given such notice for the first time not later than the 10th day of July in each year, or such other earlier date as may be fixed by by-law of the municipality.

(2) In case such owner or occupant of land (or, if it be railway property, then the station master upon whom notice has been served) refuses or neglects to cut down or destroy all or any of the said noxious weeds within the period aforesaid, the inspector shall enter upon the land and cause such weeds to be cut down or destroyed with as little damage to growing crops as may be, and he shall not be liable to be sued therefor; or the inspector, instead of entering upon the land and causing such weeds to be cut down or destroyed, may lay information before any Justice of the Peace as to such refusal or neglect, and such owner or occupant shall, upon conviction, be liable to the penalties imposed by Section 10 of this Act.

(3) But no inspector shall have the power to cut down or destroy noxious weeds on any land sown with grain; and where such noxious weeds are grown upon non-resident lands it shall not be necessary to give notice before proceeding to cut down or destroy the same.

5.—(1) The inspector shall keep an accurate account of the expense incurred by him in carrying out the provisions of the preceding sections of this Act with respect to each parcel of land entered upon therefor, and shall deliver a statement of such expenses, describing the land entered upon, and verified by oath, to the owner or occupant of resident lands, requiring him to pay the amount.

(2) If any owner or occupant of land amenable under the provisions of this Act deems such expense excessive, an appeal may be had to the said council (if made within thirty days after the delivery of such statement), and the said council shall determine the matter in dispute.

(3) In case the owner or occupant of resident lands refuses or neglects to pay the same within thirty days after such request for payment, the said claim shall be presented to the council of the municipality in which such expense was incurred, and the said council is hereby authorized and required to audit and allow such claim, and order the same to be paid from the fund for general purposes of the said municipality.

6. The inspector shall also present to the said council a similar statement, verified by oath, of the expenses incurred by him in carrying out the provisions of this Act upon any non-resident lands; and the council is hereby authorized and required to audit and allow the same, or so much thereof as to the council may seem just, and to pay so much thereof as has been so allowed.

7. The council of the municipality shall cause all such sums as have been so allowed and paid by the council under the provisions of this Act to be by the clerk severally placed on the collector's roll of the municipality against the lands described in the statement of the inspector, and to be collected in the same manner as other taxes imposed by by-laws of the municipality.

8. If written complaint be made to the inspector that yellows or black-knot exist within the municipality, in any locality described in such complaint, with reasonable certainty, he shall proceed to examine the fruit trees in such locality, and if satisfied of the presence of either disease he shall immediately give notice in writing to the owner or occupant of the land whereon the affected trees are growing, requiring him within five days from the receipt of the notice to deal with such trees in the manner provided by section 2 of this Act.

. It shall be the duty of the overseers of highways in any municipality to see that the provisions of this Act relating to noxious weeds are carried out within their respective highway divisions by cutting down or destroying, or causing to be cut down or destroyed at the proper time to prevent the ripening of their seed, all the noxious weeds growing on the highways or road allowances within their respective divisions; such work to be performed as part of the ordinary statute labor, or to be paid for at a reasonable rate by the treasurer of the municipality, as the council of the municipality may direct.

10.—(1) Any owner or occupant of land who refuses or neglects to cut down or destroy any of the said noxious weeds, after notice given by the inspector, as provided by section 4, or who knowingly suffers any of the said noxious weeds to grow thereon, and the seed to ripen so as to cause or endanger the spread thereof, or who suffers any black-knot to remain on plum or cherry trees, or keeps any peach, nectarine or other trees infected with yellows or the fruit of trees so infected, shall, upon conviction, be liable to a fine of not less than $5 nor more than $20 for every such offence.

(2) Any person who knowingly sells or offers to sell any grass, clover or other seed, or any seed grain among which there is seed of Canada thistles, ox-eye daisy, wild oats, rag-weed, burdock or wild mustard shall, for every such offence, upon conviction, be liable to a fine of not less than $5 nor more than $20.

(3) Any person who knowingly offers for sale or shipment or sells or ships the fruit of trees infected with yellows, shall, upon conviction, be liable to a fine of not less than $5 nor more than $20.

(4) Every inspector, overseer of highways or other officer, who refuses or neglects to discharge the duties imposed on him by this Act shall, upon conviction, be liable to a fine of not less than $10 nor more than $20.

(5) Any person who sows any wheat or other grain knowing it to be infected by the disease known as smut, without first using some proper and available remedy to destroy the germs of such disease shall, upon conviction, be liable to a fine of not more than $20.

11. Every offence against the provisions of this Act shall be punished, and the penalty imposed for each offence shall be recovered and levied, on summary conviction before any Justice of the Peace; and all fines imposed shall be paid to the treasurer of the municipality in which the offence is committed, for the use of the municipality.

12. The council of every municipality in Ontario shall require its inspector, overseer of highways and other officers to faithfully discharge all their duties under this Act.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION.

BULLETIN LXXXVI.

ROOTS, POTATOES AND FODDER CORN.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B.S.A., EXPERIMENTALIST.

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BULLETIN LXXXVI.

ROOTS, POTATOES AND FODDER CORN.

The returns from the Bureau of Industries give the area of the root crop grown in 1892 as 161,594 acres with a yield of 77,719,476 bush.; that of the potato crop as 145,703 acres with a yield of 12,289,817 bush., and that of the fodder corn crop as 91,403 acres with a yield of 948,907 tons. The importance therefore of these crops to the farmers of this province amply justifies the attention that is being given to them by way of experiment at the station during recent years.

The following are the principal objects of this bulletin, viz.: (1) To give comparative results obtained from growing leading varieties of roots, potatoes and fodder corn side by side and under the same conditions for one year and in the case of some of them for a longer term; and (2) to give comparative results from growing fodder corn at different distances apart between the drills and also in the drills.

In 1892, 62 varieties of turnips, 38 of mangels, 23 of carrots and 10 of sugar beets were grown at this station and practically under the same conditions. Each plot was one one-hundredth of an acre in size. In all instances the drills were 3½ links or 27.7 inches apart, and they were ridged. The soil was a clay loam; it had been in sod for a number of years and was broken up after the removal of the hay crop in 1890. Potatoes followed in 1891. Fresh farm-yard manure was applied in the winter of 1891-2 at the rate of about 15 tons per acre.

Swede Turnips. 44 varieties were grown. The seed was sown June 15th. The plants were thinned to an average distance of 12 inches in the drill. The following table gives the results from the 6 varieties which gave the highest yields:

Varieties.	Yield of tops per acre, 1892.	Average weight per root for two years.	Yield of roots per acre, 1892.	Yield of roots per acre, average two years.
	tons.	℔	tons.	tons.
1. White Swede	5.98	2.53	25.13	22.53
2. Hazard's Improved	5.00	2.70	19.50	21.31
3. Sutton's Champion	4.58	2.55	19.03	21.29
4. Our Selected purple top	3.90	2.49	19.45	21.20
5. Green top	6.18	2.44	21.35	21.05
6. Hartley's bronze top	4.00	2.37	17.96	20.95

The White Swede which heads the list in point of yield for one year and for two years is short in the neck, large in size and firm in flesh. We learn from the co-operative experiments that Carter's Elephant, which did not get a place in the above list, gave satisfactory returns throughout the province.

White fleshed and Yellow fleshed Turnips. 18 varieties were grown. The plants were thinned to an average distance of 12 inches in the row. The seed was sown June 21st. These varieties are all white fleshed. The following table gives the comparative results from the 6 varieties which gave the highest yields :

Varieties.	Yield of tops per acre, 1892.	Average weight per root for two years.	Yield of roots per acre, 1892.	Average yield of roots per acre for two years.
	tons.	℔	tons.	tons.
1. Jersey Navet	4.35	2.91	21.38	24.81
2. Greystone	6.50	2.66	18.40	23.24
3. Red Globe Norfolk	4.68	2.73	17.78	23.24
4. Greystone Improved	8.18	3.10	16.20	22.74
5. Purple top Maine	6.58	2.71	19.33	22.71
6. Early American purple top	5.10	2.40	21.50	21.80

The Jersey Navet which heads the list was not so firm in flesh as the four varieties which come after it in point of yield. The Red Globe Norfolk is first amid the varieties grown for three years. The 10 white fleshed varieties averaged 21.8 tons per acre and the four yellow fleshed 15.4 tons.

Mangels. 38 varieties were grown. The plants were thinned to the average distance of 12 inches in the drill. The seed was sown April 30th. The table below gives the comparative results from the 6 varieties which gave the highest yields :

Varieties.	Yield of tops per acre, 1892.	Average weight per root for two years.	Yield of roots per acre, 1892.	Yield of roots per acre, average for two years.
	tons.	℔	tons.	tons.
1. Carter's Champion Yellow Intermediate	4.93	2.72	25.78	29.94
2. Improved Mammoth Prize Long Red	4.45	2.33	20.65	28.11
3. Evans' Improved Mammoth Sawlog	4.28	2.44	21.35	27.68
4. Steele Bros.' Long Red Selected	4.40	2.41	21.03	27.18
5. Carter's Mammoth Long Red	6.25	2.42	25.80	26.49
6. Elvetham Long Red	6.00	2.29	27.20	26.27

The yield from Carter's Champion Yellow Intermediate for two years was 998 bush. per acre. The Improved Mammoth Prize Long Red which stood at the head of the list in 1891 gave an average yield of 937 bush. per acre for two years. The Yellow Oberdorf, first in point of yield among the Globe varieties, is twelfth in the list of 31 varieties. The 13 distinctively long varieties gave a yield of 24.6 tons per acre and the 10 Globe varieties a yield of 18.8 tons.

Carrots. 23 varieties were grown. The plants were thinned to an average distance of 3 inches in the line of the drill. The seed was sown April 30th. The table below gives the comparative results from the 6 varieties which gave the highest yields in 1892 :

Varieties.	Labor in pulling.	Average weight per carrot.	Yield of tops per acre.	Yield of roots per acre.
		oz.	tons.	tons.
1. Improved Short White	easy	15.6	10.2	37.3
2. Pearce's Improved Half Long White	"	15.6	10.2	36.5
3. Large White Vosges	"	13.8	8.5	33.9
4. White Green top Orthe	"	14.3	7.8	32.6
5. Simmer's Short White Vosges	"	13.9	7.4	32.3
6. Large White Belgian	hard	13.9	9.5	31.8

The average yield of the 6 varieties in the table is 1,135 bush. per acre, and of 23 varieties grown 906 bush. per acre. The 7 best yielding varieties were all white and the 5 best yielding sorts were all easy to pull. The Improved Short White is a grand field carrot. It is of medium length, sound in flesh, smooth in shape and easy to harvest and handle.

Sugar Beets. 10 varieties were grown. The distance between the drills was the same as with the other varieties of roots, viz. : 27.7 inches apart. The plants were thinned to the average distance of 12 inches in the drill. The seed was sown April 30th. The following table gives the comparative results from the 6 varieties which gave the highest yields :

Varieties.	Uniformity of roots.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
		tons.	lb.	tons.
1. White Silesian	good	6.93	1.83	17.70
2. Red top	good	5.05	1.77	17.63
3. Vilmorin's Improved White	medium	7.13	1.66	16.28
4. French White	medium	2.83	1.63	16.25
5. Lane's Improved	good	3.28	1.58	16.20
6. Champion	good	4.83	1.45	13.93

The White Silesian, which is more commonly grown for feeding purposes gave the highest yield, viz.: 17.70 tons or 590 bush. per acre. The six varieties gave an average yield of 16.33 tons, or 544.3 bush.

Potatoes. 118 varieties were grown. The plots were one one-hundredth of an acre in size. There were 2 drills in each plot and the drills were 27.7 inches apart. The soil was a light colored loam. It had produced hay for a number of years previous and was plowed just after the removal of the hay crop of 1891. No fertilizer of any kind was applied. The seed was planted May 14th. The same amount of seed was used and the tubers were planted one foot apart in the drill. The cultivation was practically flat. The table below gives a comparison of results from the 6 varieties which gave the highest yields.

Varieties.	Percentage of crop marketable.	Weight of 30 best developed potatoes.	Yield per acre 1892.	Average yield per acre, 3 years, 1890-91-92.
		lb.	bush.	bush.
1. Empire State	96.5	9.8	120.0	168.6
2. Summit	90.9	10.5	187.1	160.6
3. Thorburn	93.7	11.0	185.4	148.0
4. London	78.3	7.3	165.4	138.0
5. Clark's No. 1	88.5	7.8	127.1	134.3
6. Early Maine	77.1	6.3	112.9	131.6

The Empire State and the Summit at the head of the list in the above table, also head the list in the co-operative experiments carried on over the Province in 1892. Both varieties are good for the table. Tonhocks heads the list of 16 varieties grown for two years. It is a good potato for the table as is also the Convoy which comes second in the list for two years.

Planting Fodder Corn in different ways. Triplicate tests were made with three varieties of Fodder Corn grown with drills different distances apart, and also different distances between the plants in the drill. The varieties used were the Mammoth Southern Sweet, Wisconsin Earliest White Dent and Compton's Early. In the absence of analyses the following conclusions have been reached, viz.: 1. That the best results were obtained from growing the Mammoth Southern Sweet in drills 42 inches apart and the plants 12 inches apart in the drill. 2. That with the Wisconsin Earliest White Dent, the best results were obtained with the drills 30 inches apart and 12 inches between the plants, and 3. That with Compton's Early the best results were obtained from corn grown with 30 inches between the drills and 4 inches between the plants in the drill.

Fodder Corn. 64 varieties of fodder corn were grown at the station during 1891 and 1892. They were all planted upon duplicate plots each year. The seed was dropped in hills 5 links or 39.6 inches apart both ways. Seeding took place in 1892, on May 14th, with one set of plots, and on May 28th with the duplicate plots. Four plants were allowed to grow in each hill in 1891 and five in 1892. Thorough shallow cultivation was given the rows both ways.

The results from seven varieties which gave the highest yields for two years, are as follows :

Varieties.	Kind of Corn.	Condition of grain when harvested.	Yield of ears per acre when harvested.	Average yield of crop per acre 1891–1892.
			lb.	tons.
Mammoth White Surprise........	white dent...	water	1,894	22.2
Brazilian Flour	white flint...	water	484	22.0
Chester County Mammoth........	yellow dent..	water	2,340	20.9
Mastodon Dent	yellow dent..	late milk..	5,717	20.0
Blunt's Prolific	white dent...	early milk.	2,508	20.0
Cloud's Early Yellow	yellow dent..	dough	6,898	20.0
Thoroughbred White Flint........	white flint..	dough	3,494	19.9

The varieties mentioned in the above list, although heavy yielders, are somewhat late in reaching maturity. The Thoroughbred White Flint which has been grown at this station for several years and also distributed over Ontario for co-operative tests, has shown itself to be well suited to the southern portions of the Province. Of the earlier maturing varieties the Mammoth Cuban, Salzer's South Dakota, Salzer's North Dakota, Wisconsin Earliest White Dent and Compton's Early have done exceedingly well. The Giant Beauty and the Silver Flint are very promising of the varieties grown for one year only.

CONCLUSIONS.

The following conclusions may be safely drawn from the different experiments summarised in the Bulletin :

(1) That several of the most promising varieties of roots, potatoes and fodder corn are comparatively new in Ontario.

(2) That the roots and potatoes grown for two years, mentioned in this bulletin, gave the following yields per acre : Mangels 920.4 bush., Fall Turnips 769.6 bush., Swede Turnips 712.9 bush. and Potatoes 149.7 bus.

(3) That white fleshed turnips gave better yields than the yellow fleshed varieties; the long shaped Mangels better than the globe varieties; the white Carrots better than the yellow varieties and the dent corns better than the flint varieties.

(4) That, of the roots grown on the station plots for two years, the White Swede Turnip, the Jersey Navet Fall Turnip, the Carter's Champion Yellow Intermediate Mangel, and of those grown for one year only, the Improved Short White Carrot and the White Silesian Sugar Beet, gave the highest yields in their respective classes.

(5) That in the plot experiments at the station for three years with 32 varieties of potatoes and also in the co-operative tests over Ontario during 1892 with 6 varieties, the Empire State and the Summit varieties came first and second in point of yield.

(6) That, of the kinds of fodder corn tested, the Mammoth White Surprise, Giant Beauty, Thoroughbred White Flint, Mammoth Cuban, Wisconsin Earliest White Dent and Salzer's South Dakota are leading varieties among the late, medium, and early maturing classes.

(7) That when both yield per acre and stage of maturity are considered, the best results were obtained in 1892 by growing a large variety of corn with one plant to every 504 sq. in. a medium variety with one plant to every 360 sq. in., and a small variety with one plant to every 120 sq. in.

Circulars regarding the distribution of seed.

The seed of some of the leading varieties of roots and fodder corn will be distributed, by mail, free to the farmers of Ontario, through the medium of the Ontario Agricultural and Experimental Union. For *circular giving necessary information* apply to C. A. Zavitz, Experimental Station, Guelph, Ontario.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION.

BULLETIN LXXXVII.

REMEDIES FOR COMMON PLANT AND INSECT FOES.

BY J. H. PANTON, M.A., PROFESSOR OF NATURAL
HISTORY AND GEOLOGY.

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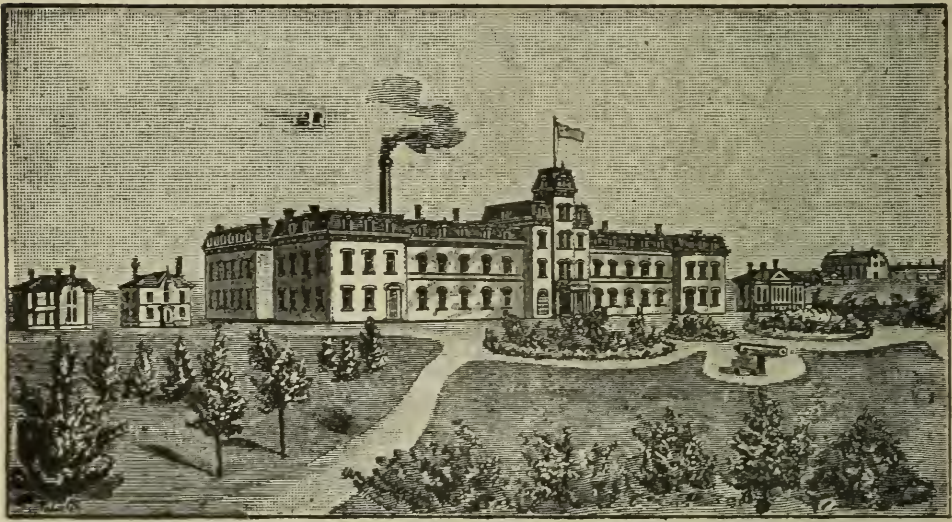

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BULLETIN LXXXVII.

REMEDIES FOR COMMON PLANT AND INSECT FOES.

So numerous have been the applications for Bulletin LXXIII, referring to some of the most common insecticides and fungicides, that it has been found necessary to prepare another bulletin upon the subject. Reference will now be made not only to the mixtures commonly used, but also to the way of applying them against specific forms of plant and insect enemies.

FUNGICIDES.

Fungicides may be defined as chemical compounds or mixtures used for the purpose of destroying such injurious forms of plant life as live upon other plants by absorbing their juices, whereby they affect their vitality. The *rusts*, *smuts*, *mildews* and *blights* are examples of such parasitic forms of plant life. Among the most common fungicides are the following :

Bordeaux Mixture. There are various forms of this mixture, the following being most commonly used :

(1) Consists of six lb. of copper sulphate, 4 lb. lime and 22 gals. of water. This may be prepared as follows : Dissolve the copper compound in sixteen gals. of water ; slake the lime in 6 gals. of water, and when the latter is cooled pour it into the copper solution and mix thoroughly.

(2) A modified form is made by taking 4 lb. of copper sulphate, 4 lb. of lime and 50 gals. of water (Green's formula).

(3) Another form is made by taking 6 lb. of copper sulphate, 4 lb. of lime and 50 gals. of water (Weed's formula).

These diluted mixtures have been proved to be very successful, and are now commonly used An advantage is gained by using Bordeaux mixtures, since Paris green may be added so as to combine insecticide and fungicide. So far experience indicates the Bordeaux mixture to be one of the best fungicides known.

Eau Celeste. Consists of 2 lb. of copper sulphate, 1 quart of ammonia and 50 gals. of water. Dissolve the copper sulphate in 2 gals. of hot water ; as soon as cool add the 1 quart ammonia and dilute to 50 gals.

A modified form has been very successful, viz.: 2 lb. copper sulphate dissolved in 2 gals. of water, 2½ lb. of sodium carbonate (washing soda) dissolved in another vessel. Mix these and when chemical action has ceased add 2 quarts of ammonia and dilute to 50 gals.

Copper Sulphate. 1 lb. copper sulphate in 25 gals. of water; spray early upon vines, etc., before leaves appear.

Ammoniacal Solution of Copper Carbonate. Dissolve 3 oz. of copper carbonate in 2 quarts of ammonia, and when about to use dilute it to 50 gals.

Galloways Mixture No. 5. Equal parts ammoniated copper sulphate and ammonia carbonate, used at the rate of 8 to 12 ounces in 25 gals. of water.

Potassium Sulphide. Consists of 1 oz. potassium sulphide to 2 gals. of water.

INSECTICIDES.

These are compounds or mixtures used to destroy insects injurious to vegetation.

Paris Green. (Arsenite of copper, containing 50-60 per cent. of arsenic.) This is applied dry or in solution. In the dry form it should be mixed with 50 to 100 parts of plaster, wood ashes, flour or air-slacked lime, and dusted upon the affected plants. The form in solution is usually 1 lb. of Paris green to 200 gals. of water, but if the foliage is tender 250 to 300 gals. of water may be used. This is the usual strength applied upon the plum and peach. As the green powder does not dissolve it requires to be kept thoroughly mixed by constant stirring.

London Purple. This is an arsenite of lime obtained as a by-product in manufacturing dyes. It is largely used instead of Paris green; but being more soluble in water it is apt to injure the foliage, and, besides, its composition varies considerably so that when used it is not likely to give as uniform results as Paris green.

These arsenites are excellent against all leaf-eating insects.

Kerosene Emulsion. This is a mixture of coal oil and water. There are three formulas used to a considerable extent:

(1) *Riley-Hubbard Emulsion.* Consists of ½ lb. of hard soap in 1 gal. of water. Boil till dissolved, and then add 2 gals. of coal oil, and mix thoroughly for about five minutes. When properly mixed it will adhere to glass without oiliness. This can be done by forcing it through the nozzle of a force-pump repeatedly until the mixture appears complete. It will then form a creamy mass which thickens into a jelly-like substance on cooling. In using, dilute with 9 parts of soft water.

(2) *Cook's Emulsion* (soft soap). Take 1 quart of soft soap and 2 quarts of boiling water, and while hot add 1 pint of coal oil; mix thoroughly as above. In using dilute with an equal amount of water, either hard or soft.

(3) *Cook's Emulsion* (hard soap). Take ¼ lb. of hard soap, 2 quarts of hot water and 1 pint of coal oil; thoroughly mix while hot. In using dilute with twice the amount of either hard or soft water.

Emulsions are successful against plant lice and scale insects.

Hellebore. This is the powdered root of a plant (Veratrum album). It may be applied dry, or in solution at the rate of 1 oz. to 3 gals. of water.

Pyrethrum. Made from the powdered flowers of the genus pyrethrum, a plant of the sunflower family. It should be fresh, and hence ought to be kept in closed vessels. It may be used in dry form, 1 part pyrethrum to 5 or 8 parts of flour, or in liquid form in the proportion of 1 oz. in 3 gals. of water.

Carbolic Acid Emulsion. Consists of 1 part carbolic acid to 7 parts of a solution consisting of 1 quart of soft soap or 1 lb. of hard in 2 gals. of water.

Tobacco. The refuse from cigar factories is good, either dusted on in the form of a powder, or used as a solution in the proportion of 1 lb. in 2 gals of water.

Whale Oil Soap. This may be used in the proportion of 2 oz. of the soap to 1 gal. of water.

Alkaline Wash. A strong solution of washing soda mixed with soft soap until about as thick as paint.

Carbolized Plaster. Consists of 1 pint of carbolic acid and 50 lb. of land plaster.

Combined Mixtures. By the combination of an insecticide with a fungicide we are able at the same time to cope with injurious insect and plant life. A good example of this can be seen in the application of a combined mixture to potatoes, in which case the beetle may be destroyed and the blight prevented. While combatting the "spot" of the apple the coddling moth may also be fought if a combined mixture be used.

(1) 4 oz. of Paris green added to Bordeaux mixture (No. 2 or 3) makes an excellent combination.

(2) The following is also recommended: 2 oz. of Paris green and 2 oz of copper carbonate dissolved in 3 pints ammonia, ½ lb. of lime added to 32 gals. of water, and the whole thoroughly mixed. It is necessary to add the lime, or the foliage will be damaged.

PRECAUTIONS IN SPRAYING.

1. Keep poisons labelled, and out of the way of children.
2. Do not spray so far into the season as to affect the fruit.
3. In making emulsions remember the inflammable nature of coal oil.
4. *Never spray trees in bloom.*
5. Try solutions on a small scale if likely to injure foliage, and watch results.
6. Be careful and thorough in your work.

Careful analyses show that there is no ground for alarm regarding the effect of spraying fruit trees with Paris green.

The foregoing mixtures are usually applied by spraying machines, which can be procured through any responsible seedsman. As copper compounds act upon tin and iron it is well to prepare such mixtures in earthen, wooden or brass vessels.

The Bordeaux mixture is rather dirty to work with, and inclined to clog the jet. Nevertheless it is about as effectual a fungicide as has yet been discovered. If used too long in the season it is apt to affect the appearance of the fruit. This can, however, be washed off with a dilute solution of vinegar.

Cost of the Mixtures. A fair idea of the cost of the various mixtures may be had upon an examination of the following price list of substances used in the different formulas:

Ammonia	25c. per lb.	Pyrethrum,	40c. per lb.
Copper carbonate,	60c. per lb.	Copper sulphate,	12c. per lb.
Paris green,	30c. "	Hellebore,	25c. "
London purple,	15c. "	Sodium carbonate	5c. "

REMEDIES FOR CERTAIN INJURIOUS FUNGI.

1. *Apple Spot.* (1) Spray with Bordeaux mixture No 2, making first application in spring before the blossoms open. Spray again as soon as the fruit is well formed. Now add 3 oz. of Paris green to the barrel and make three applications at intervals of two weeks. These last applications will destroy insects as well as the spores of the "spot" fungus.

(2) Copper carbonate ammoniacal solution referred to and Eau Celeste are also good remedies. With these the first application should be made previous to blossoming, the second when the fruit is about the size of peas, and the third two or three weeks later.

2. *Brown Rot* of plum, cherry and peach. Use the Bordeaux mixture in the same way as for apple "spot." Burn all affected fruit and leaves in the fall. If "rot" should set in make one or two sprayings with copper carbonate solution.

3. *Pear Leaf Blight*, which appears on both leaves and fruit, giving the leaves a spotted appearance and causing the fruit to crack.

(1) Spray with ammoniacal solution of copper carbonate as soon as the leaves begin to open, and repeat two or three times at intervals of two weeks.

(2) Use Bordeaux mixture as for apple "spot."

4. *Strawberry Leaf Blight.* Spray during July and August, every two weeks, with the following solution: 4 oz. of copper carbonate and two quarts of ammonia in a barrel of water.

5. *Gooseberry Mildew.* Spray with 1 oz. of potassium sulphide in two gallons of water. Begin as soon as the leaves are opening, and repeat about every three weeks.

6. *Grape Black Rot.* Spray with ammoniacal solution of copper carbonate of Bordeaux mixture (No. 2 or 3) six times, every two weeks, commencing early in May. If the last two sprayings are with the copper carbonate the fruit will not be disfigured.

7. *Grape Down Mildew.* Spray with Eau Celeste about ten days before blossom ; give another application as soon as the berries are set, and a third about three weeks later.

8. *Raspberry Cane Rust.* Spray with Bordeaux mixture (No. 2) before the leaves appear and two or three times after; but not after the blossoms open.

9. *Potato Blight.* Apply Bordeaux mixture (No. 2) three or four times, administering the first when the plants are about six inches high. If ½ lb. of Paris green be added to the mixture beetles may also be destroyed at soon as they appear.

10. *Smut.* (1) Immersing seed in hot water of 135° Fahr. for five minutes will destroy the spores of smut. 5° above or below that point will fail.

(2) Put 1 lb. of copper sulphate in 20 gallons of water and allow the seed to remain in this for about 15 hours; then put the seed for 10 minutes in lime water made by slaking the lime in ten times its weight of water.

REMEDIES FOR SOME COMMON INJURIOUS INSECTS.

1. All *Leaf-eating* insects, such as canker worms, tent caterpillar, grape flea beetle, Tussock moth, fall web-worm, etc., are readily destroyed by spraying with Paris green, 1 lb. to 200 gallons of water.

2. *Borers* of the apple tree trunk and peach can be overcome by applying late in May or early in June to the trunks and large branches the following solution : 1 quart of soft soap or 1 lb. of hard soap in 2 gallons of water ; heat to boiling point and add 1 pint of crude carbolic acid. It is well to scrape off the rough bark first, and then rub the mixture well on.

3. *Bark Lice.* Scrape off the bark during the winter and early spring, and rub on a solution made by adding one part of crude carbolic acid to 7 parts of a solution of soft soap 1 quart, or hard soap ¼ lb. in 2 quarts of boiling water. As soon as the young lice are hatched and begin to move (about June) spray the tree with a kerosene emulsion.

4. *Codling Moth,* or apple worm. As soon as the petals have fallen spray with a solution of 1 lb. of Paris green in 200 gallons of water; ten days later give a second application, and if necessary a third spraying may be given later on.

5. *Plum Curculio.* Spray with 3 oz. of Paris green to 50 gallons of water as soon as the blossoms have fallen, and give two more applications at intervals of about ten days. Jarring the trees and collecting the insects as they fall upon sheets is also much followed.

6. *Bud Moth.* This insect destroys the flower bud of plums, pears and apples. Spray with ordinary Paris green mixture when the buds begin to swell, and again in about ten days, that is, before the blossoms open. Kerosene emulsion is also recommended.

7. *Pear and Cherry Tree Slug.* Spray with either Paris green, hellebore or pyrethrum. Paris green in the proportion of 1 lb. to 250 gallons of water may be used for both broods if the trees are not bearing; otherwise use the Paris green for the second and either of the other remedies for the first brood.

8. *Potato Beetle.* Spray the vines with Paris green, using 6 oz. to 50 gallons of water.

9. *Squash Bug.* The young ones can be destroyed with kerosene emulsion; but those matured require to be hand-picked or caught under pieces of board placed among the plants where the bugs collect at night.

10. *Cucumber Beetle.* Cover the plants with netting so as to keep the beetles off.

11. *Plant Lice.* Use kerosene emulsion.

12. *Pea Weevil.* (1) Sow unaffected peas. (2) Heat affected peas as soon as gathered for 1 hour at a temperature of 145°. (3) Immerse affected seed peas in hot water, adding almost at once cold water, and leave for 24 hours.

13. *Strawberry Slug.* Spray the first brood with pyrethrum and the second with Paris green.

14. *Currant Worm.* Spray with hellebore 1 oz. to 3 gallons of water.

15. *Onion and Cabbage Maggots.* Use kerosene emulsion, and apply it in the vicinity of the plants. Carbolic emulsion has been very successful against the "radish maggot."

16. *Turnip Flea Beetle.* Dust upon the attacked plants while the dew is still on them 1 part of Paris green and 50 parts of land plaster. Tobacco dust is also effectual.

17. *Ground Cutworms*, etc. (1) Surround the stem of the plant with heavy paper. (2) Sprinkle Paris green upon small bunches of fresh clover, and then scatter them about where the worms are working. They will serve as baits and poison many of the worms.

18. *Common Cabbage Worm.* Spray with a solution of 1 oz. of pyrethrum in 4 gallons of water. Kerosene emulsion may also be used on young plants.

In order to make this bulletin as concise and simple as possible many remedies have been omitted, and only the most successful noted. No description has been given, and only the common names of injurious plants and insects referred to have been used, as being sufficient for practical purposes. If further information is required it will be readily given on application to the writer.

ONTARIO AGRICULTURAL COLLEGE

DAIRY DEPARTMENT.

BULLETIN LXXXVIII.

THE MAKING OF CHEESE.

BY THE SPECIAL DAIRY SCHOOL.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE

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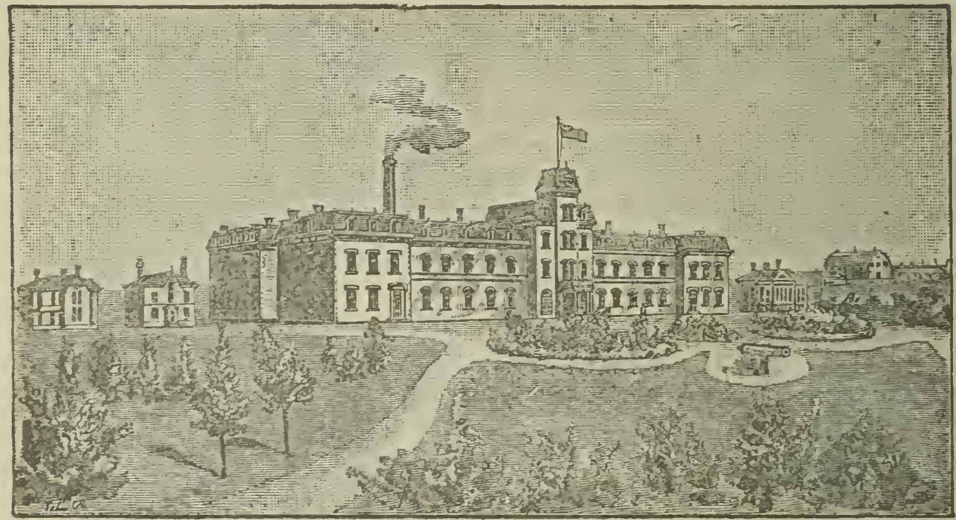

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BULLETIN LXXXVIII.

THE MAKING OF CHEESE

IN SPRING, SUMMER AND FALL.

This Bulletin has been prepared by Committees of the Special Dairy School, 1893, at the Ontario Agricultural College as follows:

Spring Cheese:

A. T. Bell, Tavistock, Ont.,
(Chief Instructor in Cheese-making.)
W. W. Grant, Lakefield, Ont.
L. A. Zufelt, Morrisburg, Ont.

Summer Cheese:

A. T. Bell, Tavistock, Ont.,
(Chief Instructor in Cheese-making.)
L. Patton, Oxford Mills, Ont.
J. S. Clark, Warwick, Ont.

Fall Cheese:

T. B. Millar, Burgoyne, Ont,
(Asst. Instructor in Cheese-making.)
W. Bothwell, Woodstock, Ont.
C. Stewart, Flesherton, Ont.

CARE OF MILK FOR CHEESE FACTORIES.

In order to maintain the proud distinction that Canadian cheese has already won in the British markets it is absolutely necessary that the dairymen shall put forth greater efforts than they have in the past to produce a better quality of milk. Progress must be the watchword.

The maximum of profit can be obtained only by the clear-thinking, intelligent dairyman, who breeds and feeds to produce the greatest amount of milk of a good quality at the least possible cost.

The faithful and constant observance of the following points will result in a marked improvement in the condition of the milk supplied to the cheese factories, an improvement which is much needed, and the bringing about of which will enable the cheese-maker to produce an article much superior to anything that has been made in the past, and by so doing we can maintain our supremacy in the English market, realize a better price for our goods, and add very materially to the profits of the dairyman.

Nothing but pure milk from healthy cows should be sent to the factory. To secure this, cows should have abundance of wholesome, nutritious food and pure water, with access to salt at all times.

The greatest possible care should be taken to prevent cows drinking stagnant water. Milk from such cows is invariably tainted, and no amount of skill on the part of the cheese-maker can produce from it a really fine cheese.

Immediately after the milk is drawn it should be strained, then aerated by dipping or pouring, which can be done very effectively while the milk is yet in the pails. Be sure that this work is done in a pure atmosphere, with clean surroundings, away from the stables or anything else of an impure nature, for unless this be attended to properly aeration will be a detriment instead of a benefit.

It is not necessary to cool milk at night, unless the weather be extremely hot, in order to have it in the best condition for delivery at the factory in the morning (provided all pails, utensils, strainers, etc., have been thoroughly washed, then scalded with boiling hot water and well aired before using).

It is just as important that the morning's milk should be well aired before sending it to the factory; not only in the summer should milk be aerated, but also in the spring and autumn.

The milk stands should be built in such a way as to exclude the sun and rain, and yet allow a free circulation of air around the cans.

The organisms that produce bitter or tainted milk, or any abnormal change, are to be found only where there is filth and carelessness in handling, so that in all cases when complaint is made of impure milk the remedy must be *extra cleanliness.*

Spring Cheese.

The cheese-maker who is desirous that his cheese shall be of the finest quality will accept nothing but good, pure milk. All tainted or sour milk and the first milkings (colostrum) should be refused.

Heat the milk to 84° Fahr. The rennet test should then be used to ascertain the degree of ripeness. To make this test take 8 oz. of milk from the vat, add to it one drachm of rennet extract, stir rapidly for ten seconds. If coagulation takes place in from 17 to 20 seconds the milk is sufficiently matured for the addition of rennet. A slight variation from this may be necessary to suit different localities, but a few trials will enable the maker to tell when the milk is properly ripened. A very simple way to tell the exact moment when coagulation takes place is to drop a bit of burnt match into the milk. It assumes a rotary motion when the milk is stirred. Then count the number of seconds from the addition of the rennet until the stick ceases to move. This gives you the exact time required for the milk to coagulate.

Great care and watchfulness should be exercised at this season, as milk sours very rapidly during the early period of lactation.

Use sufficient rennet (from 3 oz. to 4 oz. per 1,000 lb.) to coagulate the milk fit for cutting in from 15 to 20 minutes. In cutting use the horizontal knife first, then the perpendicular. Begin when the curd is somewhat tender and cut slowly, with a firm, steady motion and continuously, until the cutting is completed.

Let the curd settle a few minutes to allow the surfaces to heal slightly, then stir with the hands—very gently and slowly at first—for about ten minutes. Rough handling at this time sets free a great number of small particles of curd which go off in the whey and very materially lessen the yield. Then the agitators may be put in and the steam gradually turned on. Take about 30 or 35 minutes in heating up to 98° Continue stirring about five minutes after the steam has been turned off, when the curd may be allowed to settle. Draw off a portion of the whey at this time that you may not be caught by a rapid development of acid. Then stir the curd occasionally (a common hay rake is best suited for the purpose) to prevent matting and to secure a thorough cooking of each particle of curd.

When the curd is thoroughly cooked and shows ⅛ in. or less acid on the hot iron the whey should be removed. After dipping the curd should be well stirred with the hands to effectually drain off the whey before allowing it to mat. When it has become sufficiently matted cut into convenient strips (about 8 in. wide) and turn. In about 15 minutes they may be turned again and piled two deep. Turn frequently (four or five times an hour) to prevent any whey from collecting on or about the curd, and to ensure uniform ripening. The temperature should be maintained at about 94° while the breaking down process is going on, and when the curd presents a flaky appearance on being pulled apart and shows acid to about ¾ in. on the hot iron it may be milled and then aired by stirring occasionally. When it becomes soft and velvety, smells like newly-made butter, and shows some fat on being pressed in the hand, it may be salted at the rate of from 1½ lb. to 2 lb. of salt per 1,000 lb. of milk.

The temperature when salting should not be higher than 86°. Put to press in about 15 or 20 minutes, or when the salt is thoroughly dissolved. Have the temperature at this time between 80° and 85°, Apply pressure gently at first, until the whey begins to run clear, then gradually increase. After the cheese have been in the press about 45 minutes they may be taken out and neatly bandaged; only pure water should be used in bandaging. They should be turned again in the hoops in the morning. See that no rims or shoulders are left on the cheese, but have them neat and stylish in appearance, and of uniform size. They should be pressed for at least twenty hours before removing to curing room.

The curing room should be kept at an even temperature of about 65° or 70°, and should be well ventilated.

SUMMER CHEESE.

The same treatment is required in handling and caring for the milk. Aeration and cleanliness should have the same careful attention.

When the milk arrives at the factory each can should be subjected to a strict examination by the cheese-maker (do not leave this to the poorest helper), to detect, if possible, and reject all bad-flavored or tainted milk. There is no excuse for having milk of this kind. What one patron can do all can do—care for it properly and have it arrive at the factory in the very best possible condition.

When the milk has been received heat it up gradually to 86°. When this has been done try it with the rennet test to ascertain the degree of ripeness. It is advisable to do this even in handling very ripe milk, for it enables the cheese-maker to know just about how fast the curd is going to work. If possible have the milk in that condition that all the whey will be drawn in from 2½ to 3 hours from the time the rennet is added, with ¼ in. acid on the curd by the hot iron test. Use enough rennet to coagulate the milk sufficiently for cutting in 30 minutes.

Start to cut a little early. Take plenty of time, and do not hash or slash the curd. Use the horizontal knife first, finishing with the perpendicular, and if the milk is over-ripe and going to work fast—as is quite often the case in hot weather—then cut the curd considerably finer. By so doing the cooking process is hastened; the cubes of curd being small they are much more easily cooked than if left the ordinary size. When the cutting is finished start to stir very gently at first, or until the curd becomes somewhat firm. Do not apply heat for 10 or 15 minutes after stirring is commenced. Heat gradually up to 96°, taking fully one-half hour to do so, unless in the case of fast working curd, which requires to be heated up as quickly as possible to ensure a thorough cooking. Continue stirring for some time after the desired temperature has been reached to prevent matting and to ensure a more uniform and thorough cooking of the curd.

Draw off part of the whey soon after the heating has been finished, and if there are any bad odors or taints draw the whey down quite close to the curd ; then by keeping it stirred and airing well the flavor will be very much improved. Draw off all the whey when the curd shows $\frac{1}{4}$ in. acid by the hot iron test, and continue hand stirring until it is sufficiently dry before allowing it to mat, and when matted break or cut into convenient strips and turn it over at short intervals (about every 15 minutes) piling a little deeper each time it is turned, and never allow any whey to gather on or around it.

Grind early, or when the curd strings 1 to $1\frac{1}{4}$ in. on the hot iron. Keep it apart and well stirred and aired after grinding until ready for salting.

In the case of gassy curd, try to retain more moisture in it when the whey is drawn off by stirring less. Grind in about the usual time, and when it is partly ripe pile deep, and if the whey begins to lodge around it open the pile, allow the whey to drain off, then pile again. Continue in this way until the curd becomes velvety and buttery, when it is ready for salting. Hoop in from 15 to 20 minutes after the salt has been well stirred in.

Apply pressure very gently at first, or until the whey begins to run clear, after which it may be safely increased. In from 45 to 60 minutes the pressure may be removed, the hoops taken off, the cheese dressed neatly, and put back to press again. Apply full pressure before leaving there for the night.

Turn them in the hoops in the morning, paring off any corners or shoulders which may arise from imperfect fitting followers, putting back to press for five or six hours longer, when the cheese will be ready to take into the curing-room, which should be kept as cool as possible during summer.

We would strongly advise cheese-makers to keep a record of each vat, the condition of the milk, and how it works each day. Stencil the cheese with the date when made, the number of the vat made from, and by so doing a great many difficulties may be overcome.

Fall Cheese.

After getting the milk into the vats heat up slowly to 86° or 88°. Ripen the milk well (a few seconds less than for summer cheese) before setting, and if the weather be cold better results can be obtained by using a little clean-flavored sour milk for a starter, but do not under any circumstances use thick milk.

Enough rennet should be used to cause perfect coagulation in 40 minutes.

Begin cutting with the horizontal knife and finish with the perpendicular, cutting continuously until it is finished.

After the cutting is completed the curd should be stirred slowly and gently for 10 or 15 minutes before any heat is applied, then raise the temperature gradually to 96° or 98°, taking about 45 minutes to attain the desired temperature. Dip the curd when it shows ~~1~~¼ in. acid by the hot iron test, stir well until the whey has all escaped, then keep the curd warm (about 94°) and allow it to mat. When matted cut or break into convenient strips and turn over occasionally. Do not allow any whey to gather in pools on or around the curd. When it feels mellow or will show 1¼ in. to 1½ in. acid by the hot iron test it should be put through the curd mill. Stir and air well immediately after grinding. When the curd is well matured and has a silky, buttery appearance, the salt may be applied. Use at the rate of 2¾ lb. to 3¼ lb. of salt per 1,000 lb. of milk, varying the quantity to the amount of moisture in the curd. The temperature at this stage should be about 86°. The curd may be hooped and put to press in from 15 to 20 minutes after the salting is done. Apply pressure very slowly at first, and allow the cheese to remain in the press one hour before turning. Only pure warm water should be used when bandaging.

Turn the cheese in the hoops every morning, never allowing a cheese to be placed in the curing room unless it has a perfect finish.

The temperature of the curing room should be kept constantly between 60° and 65°.

When coloring pour the coloring into a dipper of warm milk from the vat, then draw the dipper quickly along under the surface of the milk from one end of the vat to the other, then stir well and there will be no danger of streaks in the curd. Have a dipper with a long handle for the purpose.

Rennet should be diluted to one gallon of pure water for each vat, and the milk should be well stirred for at least five minutes after the rennet has been added. In case the milk is very ripe two minutes will be ample time to stir after adding the rennet.

Everything in and about the factory should be kept scrupulously clean. The cheese-maker who fails to do this need not grumble if his patrons follow his example.

All strainers, sink-cloths, etc., should be well washed, then scalded and thoroughly aired each time they have been used.

The vats, pails, curd-sinks, etc., should be scalded with boiling hot water after washing, and if the water can run out readily they will dry off in a few minutes without wiping. Do not use a dish-cloth, as it usually leaves an unpleasant flavor.

ONTARIO AGRICULTURAL COLLEGE

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE

Toronto, May 15, 1893.

BULLETIN LXXXIX.

ANALYSIS OF FODDER CORN.

A. E. SHUTTLEWORTH, B.A SC , PROFESSOR OF CHEMISTRY AT THE ONTARIO AGRICULTURAL COLLEGE, GUELPH, ONT.

Testing six promising varieties of corn was one of the twelve experiments conducted by the Agricultural Committee of the Experimental Union during 1892. The seed was distributed from the Station by the Secretary of the Committee, who mailed samples to every farmer expressing a wish to join in that experiment. Twenty out of the number sent in full returns of the results to the Secretary. By this arrangement the varieties were tested in a great many different sections of country, including the following counties and districts : Huron, Bruce, Simcoe, Lambton, Grey, Kent, Elgin, Middlesex, Norfolk, Dufferin, Peel, Welland, Lincoln, Dundas, Prince Edward, Frontenac, Grenville, Northumberland, Muskoka and Parry Sound. At this Station the same varieties were tested, and the samples grown here were analysed to determine their relative feeding value. Following are the average yields of tests:

Varieties.	Average yield per acre of 20 Ontario returns.	Guelph Experiment Station.	
		Yield.	Maturity.
	tons.	tons.	
Mammoth Southern Sweet (dent).	19.3	22.6	Late.
Thoroughbred White Flint	18.6	19.8	"
True Leaming (dent)	17.3	19.6	Late medium.
Mammoth Cuban (dent)	16.1	19.1	Medium.
Wisconsin Earliest White Dent...	15.7	17.8	Medium early.
Compton's Early (flint)	11.8	13.8	Early.

In every variety the Station yield is a little more than the average of the twenty Ontario returns, yet by arranging the varieties according to yield, both are in the same order. The relative yield, however, does not necessarily agree with the relative feeding value per acre of the crops. This is determined by amount of crop, degree of maturity of the product, and percentage composition.

DEFINITIONS. *Ash* is the part of the fodder which remains unconsumed by burning to whiteness at the lowest possible red heat. *Crude Protein* is the muscle formers collectively. *Crude Fat* is a mixture of oils, wax, coloring matters, etc. Linseed oil is a common example. *Crude Fibre* is the woody portion of fodder. *Nitrogen-free Extract* is a mixture of substances commonly called carbo hydrates; starch and sugar are examples. *Nutrient* is any substance that nourishes. Fat, protein, starch etc., are nutrients.

Table of Composition.

Varieties.		In Fresh Material.						Calculated to Water-free Substances.				
		Water.	Ash.	Crude Portein.	Crude Fibre.	Nitrogen-free Extract.	Crude Fat.	Ash.	Crude Protein.	Crude Fibre.	Nitrogen-free Extract.	Crude Fat.
Mammoth Southern Sweet...	I.....	.....	.80	.75	5.13	.....	.52	4.15	3.92	26.55	.. .	2.69
	II....	.. .	.79	.73	5.13	..	.50	4.13	3.81	26.61	... .	2.62
	Av'ge.	80.70	.79	.74	5.13	12.13	.51	4.14	3.86	26.58	62.77	2.65
Thoro'bred White Flint....	I.....	.....	.64	.69	4.07	.....	.26	4.03	4.42	25.66	.....	1 63
	II....	.....	.65	.69	4.06	.....	.21	4.14	4 36	25.66	...	1.85
	Av'ge.	84.16	.64	.69	4.06	10.22	.23	4.08	4 39	25.66	64.13	1.74
Wilson's True Leaming	I.....	.....	.78	.91	4.40	.....	.41	4.04	4.72	22.71	.....	2.11
	II....	.....	.76	.89	4.50	.....	.46	3.97	4.60	23.71	.....	2.27
	Av'ge.	80.67	.77	.90	4.45	12.78	.43	4.01	4.66	23.24	65.90	2.19
Mammoth Cuban ..	I. ...	.....	.68	.91	4.38	.....	.33	3.62	4.67	23.20	.....	1.76
	II....	.....	.67	.91	4.56	.....	.42	3.56	4.67	24.11	.. ..	2.21
	Av'ge.	81.10	.67	.91	4.47	12.48	.37	3.59	4.67	23.65	66.11	1.98
Wisconsin Earliest White Dent....	I.....	.....	.64	.89	3.94	.....	.38	3.53	4.71	21.74	.....	2.11
	II....	.....	.66	.88	4.21	.....	....	3.64	4.67	23.22	.....	..
	Av'ge.	81.89	.65	.89	4.08	12.11	.38	3.58	4.69	22.48	67.14	2.11
Compton's Early ...	I.....	.....	.91	1.16	5.07	.....	.30	3.46	4.42	19.35	.....	1.14
	II....	.....	.96	1.19	4.92	.....	.29	3.65	4.54	18.66	.....	1.11
	Av'ge.	73.67	.93	1.17	5.00	18.94	.29	3.55	4.48	19.01	71.84	1.12
*126 American Analyses.	Max..	93.60	2.58	4.03	11.40	36.31	1.59	13.8	18.2	39.2	72.9	6.7
	Min..	51 50	0.55	0.54	1.90	3.01	.08	2.9	2.8	11.2	39.4	0.6
	Av'ge.	79.33	1.16	1.82	4.98	12.17	.54	5.6	8.8	24.1	58.9	2.6

* Including a great many varieties.

Every variety was planted May 28th and cut September 17th. It would, therefore, follow that the late maturers, as Mammoth Southern Sweet and Thoroughbred White Flint, had not reached the same degree of maturity at the time of cutting as Compton's Early, an early maturing variety; and since the proportion of water decreases with maturity, a higher per cent. of water would be expected in the later than in the early maturers. Compton's Early contained 73.67 and Thoroughbred White Flint 84.16 per cent. of water. Early maturity and a low proportion of water are found in the same variety, while late maturity and a high per cent. of water occur together. Excepting Mammoth Southern Sweet, those varieties intermediate in maturity are also intermediate in per cent. of water. These facts alone indicate that an early maturing corn is a good ensilage corn. For ensilage purposes, heavy yielders are desirable; but to make sweet, nutritious ensilage, varieties that reach a good degree of maturity in any particular locality must be grown.

The figures in the second column, under fresh material, show a great difference in the amount of crude fat contained. Excepting .29, the average in Compton's Early, and .51, the average in Mammoth Southern Sweet, the higher fat percentages are found in the dryer and earlier maturing varieties.

While the proportion of crude fibre is nearly the same in most of the varieties, it is relatively high in Compton's Early and Mammoth Southern Sweet. Probably the high degree of maturity in the former, and the natural deficiency of great leaf growth in the latter, account for the high per cent. of fibre.

Compton's Early, in the fresh condition, is considerably richer in protein than the other varieties. Mammoth Southern Sweet and Thoroughbred White Flint are relatively lower in protein, both in the fresh material and water-free substance.

It is interesting to observe, under the water-free substance, the regular increase in the proportion of nitrogen-free extract (starch and sugar) with the degree of maturity.

Nutrients Calculated to pounds per Acre.

Varieties.	Protein.	Fibre.	Nitrogen-free Extract.	Fat.
Mammoth Southern Sweet	334.48	2,318.76	5,482.76	230.52
Thoroughbred White Flint	273.24	1,607.76	4,047.12	91.08
True Leaming	353.70	1,748.85	5,022.54	168.99
Mammoth Cuban	347.62	1,707.54	4,767.36	141.34
Wisconsin Earliest White Dent	316.84	1,452.48	4,311.16	135.28
Compton's Early	322.92	1,380.00	5,227.54	80.04

This table gives the number of pounds of the several nutrients contained in the total crop of one acre for the different varieties. The numbers are calculated from the tables of composition and yield.

It is not easy to state, on the basis of composition alone, the relative nutritive value of foods of different compositions. But upon their power to produce heat, the nutritive value of foods can be compared scientifically. Based on this, the following table compares the nutritive value of the total yield per acre of these six varieties of corn. The figures are calculated from the yield and analysis of the samples grown at this Station. It must be remembered they refer to their nutritive or feeding value at the time of harvesting. The relative feeding values of the total crop of one acre of each of these varieties, at the time of harvesting, are to one another as these numbers. But made into ensilage, these varieties might not stand in the same order, owing to the influence of the maturity of a corn upon the quality of ensilage that it produced.

1.	Mammoth Southern Sweet	100
2.	True Leaming	87
3.	Mammoth Cuban	82
	Wisconsin Earliest White Dent	82
	Compton's Early	82
6.	Thoroughbred White Flint	70

PRACTICAL POINTS FOR FARMERS.

In the twenty full reports received there are twelve that may be called heavy and eight that may be called light soils.

The previous cropping, that is, the cropping of 1891, was as follows: Two experimenters cropped with fodder corn, one with winter wheat, four with oats, five with potatoes, one with pasture, two with meadow, and one each with beans, millet, alsike and rape.

In four varieties, two following potatoes and two following fodder corn, the highest yield of twenty tests was on light soils, two located in Grenville and two in Elgin. In the other two varieties, one following beans and the other following oats, the highest yield was on heavy soil. In five varieties, four following oats and one following meadow, the lightest yield in twenty tests was on heavy soils, three located in Frontenac, one in Huron and one in Peel. The lightest yield in the sixth variety was on gravelly loam after potatoes, in the county of Dundas.

These results undoubtedly indicate that heavier yields of fodder corn are obtained from light, warm soils than from heavy soils; they also lead to the conclusion that when the land is not specially manured for corn heavier yields are obtained after such crops as potatoes, roots, or even fodder corn than after cereal crops as oats, wheat, etc.

A further examination of the individual reports of the farmers who tested these varieties shows that corn may be grown successfully after pastures, alsike, red clover and rape. Speaking generally, all of these varieties have yielded well, but corn grown for the silo must yield well and mature fairly well, and therefore in selecting a corn for the latter purpose it is very important that a variety be obtained that will mature well in that particular locality.

Erratum. In Dairy Bulletin LXXXVIII, page 8, line 5, for 1¼ read ¼.

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION.

BULLETIN XC.

EXPERIMENTS WITH WINTER WHEAT.

BY THOMAS SHAW, PROFESSOR OF AGRICULTURE, AND
C. A. ZAVITZ, B.S.A., EXPERIMENTALIST.

PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
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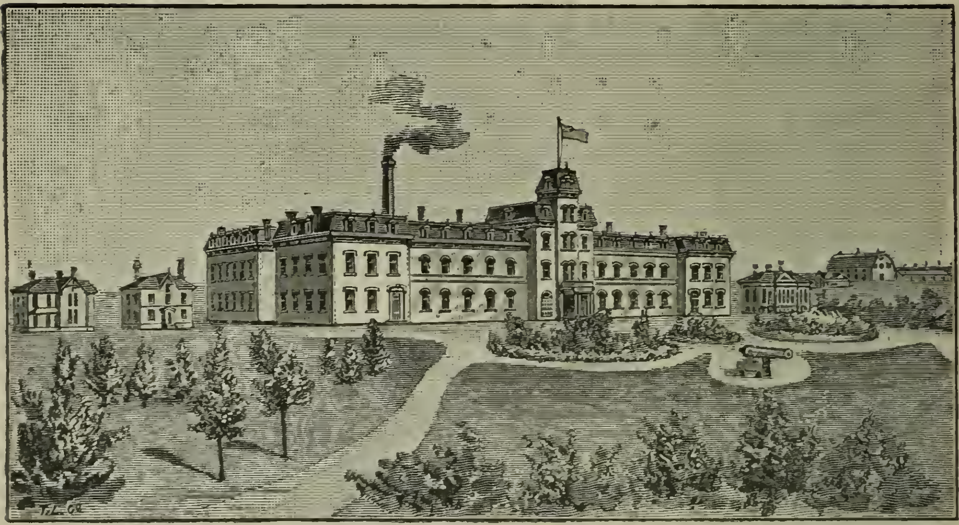
Ontario Agricultural College and Experimental Farm, Guelph, under control of the Minister of Agriculture.



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BULLETIN XC.

EXPERIMENTS WITH WINTER WHEATS.

The principal object of this bulletin is to furnish information to the farmers in an easily accessible form, which they can turn to good account when determining the varieties of winter wheat to be sown the present season. This information relates to the behavior of certain varieties of winter wheat grown at this station for one, two, three and four years respectively and under similar conditions. It furnishes important particulars relating to various characteristics and peculiarities of growth which have an important bearing on the adaptability of soils to certain varieties. These particulars are probably of more value than the comparative yields, which are also given in the bulletin.

It has been our aim during recent years to grow all the Canadian and American varieties of any promise, the seed of which we have been able to obtain. The question has in consequence been raised as to the advantage that can accrue from continuing the test with so many varieties, many of which are not likely to come into prominence. We answer that our principal aim is to prevent them from coming into prominence, and by so doing to furnish a safeguard to the farmers. Whenever the attempt is made by designing men to palm off a variety as new and superior, we have a ready means of comparison at hand for detecting the imposture as to name and properties. Could this work have been done years ago the Red Lion wheat swindlers could not have taken such large sums from unsuspecting farmers as they did in certain counties of Ontario. Many farmers at the time paid as high as $15.00 per bushel for the seed. In our experience it has proved one of the least satisfactory of all the varieties grown. If farmers will but heed carefully the work that is being done at the experiment stations in this country, the trade of the seed grain swindler cannot flourish again.

DESIRABLE QUALITIES. The qualities to be sought in winter wheat include the following: (1) Ability to give good yields; (2) the quality of the grain, including weight per bushel and value for milling purposes; (3) strength of straw; (4) non-ability to rust; (5) earliness in maturing; (6) the presence or absence of beards.

LOCATION AND SOIL. All the varieties, both native and foreign, were grown side by side in ranges separated only by temporary roads. The plots in these ranges contained each exactly one one-hundreth of an acre. The yield per acre is estimated from the actual yield of the plots. The land may be termed level, and yet it was somewhat elevated, occupying as it did the highest part of a field, the whole of which may be said to be high-lying. The soil may be designated a mild clay loam.

PREPARATION OF THE SOIL. The soil was prepared on the bare fallow system to secure uniformity of condition. This was the only bare fallow that we had upon the farm except a small portion also under preparation for experimental work. The cultivation given was much the same as is usually put upon bare fallows. Barnyard manure was applied at the rate of 15 tons per acre in the spring of 1890, and a crop of rape was grown and pastured off upon the land the same year. In 1891 a grain crop was grown. No manure has been put upon it since 1890.

SELECTION OF VARIETIES. In selecting varieties to sow, those kinds should be preferred which have given the most satisfaction during a term of years rather than for one year. Sometimes varieties do well for one year or more, and then cease to do so well thereafter.

We are now able to give facts relating to the behavior of a considerable number of varieties for four years, as shown in Table II. The aim should also be to adapt the variety to soil conditions, the more rugged and less refined varieties being better adapted to the less productive soils than the more refined sorts.

THE VARIETIES GROWN. There were in all 153 plots grown at this station during the present year, including 70 varieties. Of these, 11 of the leading varieties were grown in triplicate plots. Of the 70 varieties grown, 52 were Canadian and American, and 18 were foreign. The foreign varieties which were imported originally from Germany, England, France and Russia in 1889, are all from last year's seed. As none of these kinds have as yet proved equal to some of the best of the Canadian and American varieties, and as many of them do not ripen sufficiently early to be reported upon in the bulletin with the latter, we do not feel justified as yet in recommending the farmers to grow them. This bulletin therefore gives the particulars relating to 52 Canadian and American varieties grown under the same conditions.

MANNER AND TIME OF SEEDING. The seed was sown by hand at the rate of 1⅔ bushels per acre by weight. The plots were all sown on September 3rd with the exception of Nos. 45, 46, 48, 50 and 52, which were sown on September 9th.

THE CONDITIONS OF SEASON AND WEATHER. These varieties, speaking in general terms, came through the winter exceptionally well. The spring following was cold and backward, insomuch that growth was hindered somewhat seriously for a time. Eventually, however, the growth was rapid and the ripening early rather than late. During the ripening period the best development of the grain was hindered by unduly warm weather.

Table I gives the characteristics of 52 varieties of winter wheats :

—	Nature of head.	Color of		Date of maturity.	Height of plants.	Comparative amount of rust. 0—none. 100 much.	Per cent. of straw lodged at harvest.
		Chaff.	Grain				
				July	Inch.		
1 Surprise	Bald	White	White	22	50.5	30	30
2 Early Red Clawson	“	Red..	Red..	20	49.0	35	60
3 Golden Drop	“	“	“	20	48.0	35	60
4 Golden Cross or Volunteer	Bearded	“	“	24	51 0	50	10
5 Red Velvet Chaff	Bald	White	Red..	23	54.0	25	20
6 Rogers	“	“	“	25	53.5	45	15
7 Hybrid Mediterranean	Bearded	Red..	“	22	51.0	55	3
8 Bonnell or Landreth	Bald	White	White	25	53.0	28	10
9 Manchester	“	“	Red..	26	51.0	45	5
10 Martin Amber	“	“	White	27	52.5	43	5
11 Standard	“	Red..	“	25	50.0	55	10
12 Lancaster	Bearded	“	Red..	23	50.0	33	80
13 Seneca or Clawson	Bald	“	White	24	48.5	45	10
14 Red Lion	Bearded	“	Red..	24	51.0	40	80
15 New Monarch	Bald	White	“	23	52.0	50	10
16 American Bronze	“	“	“	23	52.5	58	3
17 Egyptian	Bearded	“	“	22	50 5	48	10
18 Jones' Winter Fife	Bald	“	“	21	49 5	33	3
19 Bulgarian	Bearded	“	White	23	48.5	33	3
20 Canadian Velvet Chaff	Bald	“	“	25	48.0	33	0
21 Garfield or Natural Cross	“	“	“	25	53.0	43	3
22 Winter Pearl	“	“	“	27	48.5	35	0
23 Democrat	Bearded	“	“	21	48.0	43	0
24 Dawson's Golden Chaff	Bald	Red..	“	23	46.0	60	0
25 Mediterranean	Bearded	White	Red..	22	46.0	43	3
26 Reliable	“	“	“	22	45.5	40	0
27 Deitz Longberry	“	“	“	21	47.5	48	0
28 Coryell	Bald	Red.	“	20	40.5	48	0
29 Russian Amber	Bearded	White	“	23	42.5	33	0
30 Rutherford	“	Red..	“	23	46.0	58	0
31 Red Wonder	“	White	“	22	47.5	45	0
32 Walker's Reliable	“	“	“	22	44.0	63	5
33 Fulcaster	“	“	“	25	45.0	43	0
34 Rumsey	“	“	White	22	45.0	43	0
35 Valley	“	“	Red..	22	44.0	40	0
36 Longberry Red	“	Red..	“	23	44.5	33	5
37 Fultz	Bald	White	“	21	43.5	53	0
38 Velvet Chaff	Bearded	Red..	Red..	22	40.0	60	0
39 Genesee	“	White	White	23	46 0	63	0
40 Monette	Bald	“	Red..	25	41.5	40	3
41 Hybrid Delhi	“	“	White	26	42.0	50	0
42 Manilla	“	“	“	27	43 5	45	0
43 Scott	“	“	Red..	25	44.0	43	0
44 Red Russian	“	Red..	“	25	44.0	43	0
45 South Sea	“	“	White	22	45.0	25	0
46 White Leader	“	White	“	24	48.0	68	0
47 Eureka	“	“	“	22	50.5	58	0
48 Soule's	“	“	“	24	49.0	58	0
49 Stewart's Champion	“	“	Red..	24	54.0	53	0
50 White Star	Bearded	Red..	“	24	48.0	38	0
51 Treadwell	“	White	White	24	49.0	50	0
52 British Columbia	Bald	Red..	Red.	26	47.0	75	0

It will be observed that of the 52 varieties in the above table the Early Red Clawson, Golden Drop and Coryell were the first to mature. Only seven days elapsed between the maturing of the earliest and the latest varieties. The amount of rust, generally speaking, was slightly greater than last year. A majority of the varieties did not lodge to any extent, and yet the Lancaster and Red Lion were badly lodged. The Early Red Clawson and Golden Drop also lodged considerably. The Surprise crinkled down much more than in previous years, and this complaint seems somewhat general the present season, in regard to this variety.

Table II gives yields of 15 varieties for four years :

Varieties.	Straw per acre (tons).		Weight per measured bushel (lb.)		Grain per acre. (bush. 60 lb.)	
	1893	Average 4 years, 1890-93.	1893	Average 4 years, 1890-93.	1893	Average 4 years, 1890-93.
1 Surprise	2.7	2.72	57.8	59.90	42.6	45.43
2 Early Red Clawson	3.2	2.72	56.5	59.05	40.3	44.36
3 Golden Drop	3.3	2.73	60.5	61.70	42.7	42.66
4 Golden Cross or Volunteer	2.9	2.61	59.3	60.80	41.5	41.81
5 Red Velvet Chaff	3.6	2.77	56.8	59.80	36.3	41.20
6 Rogers	2.8	2.60	59.5	60.70	34.9	41.15
7 Hybrid Mediterranean	3.0	2.78	59.3	60.16	40.6	40.55
8 Bonnell or Landreth	2.6	2.72	56.9	59.75	33.7	39.90
9 Manchester	2.4	2.46	58.5	61.13	34.7	39.55
10 Martin Amber	2.4	2.60	58.3	60.48	33.8	38.50
11 Standard	2.4	2.64	55.7	59.08	31.4	38.30
12 Lancaster	2.6	2.80	60.2	62.00	35.5	38.23
13 Seneca or Clawson	2.3	2.66	57.8	59.60	33.6	37.96
14 Red Lion	2.6	2.75	60.0	61.28	36.7	37.89
15 New Monarch	2.4	2.47	58.1	59.98	30.9	33.21

As the facts given in Table II relate not only to results of this year's crop, but also to the average obtained for the past four years, they may be regarded as of special importance. The average yield of grain per acre of these fifteen varieties was 30.9 bush. in 1890, 51.6 bush. in 1891, 41 bush. in 1892 and 36.6 bush. in 1893. For the four years the average was 40 bush. The average weight per bush. in 1890 was 60 lb. ; in 1891, 63.3 lb. ; in 1892, 60 lb., and in 1893, 58 lb. For the four years the average was 60.4 lb. The Surprise again heads the list among 15 varieties grown for four years, and also stands second among the 44 varieties grown in 1893. It will be remembered that this variety is possessed of good milling properties. The Early Red Clawson follows closely with an average yield of 44.4 bush. per acre. Its earliness in ripening is a strong point in its favor. The Golden Drop which stands third in the above table gave the highest yield per acre of all the Canadian and American varieties grown in 1893, and in 1892 it stood at the head of the list in point of yield along with Dawson's Golden Chaff, the yields of the two being equal. The Golden Drop as already stated is also one of the earliest varieties.

Table III gives yields of 8 varieties for three years :

Varieties.	Straw per acre. tons).		Weight per measured bushel (lb.)		Grain per acre. (bush. 60 lb.)	
	1893	Average 3 years, 1891-93.	1893	Average 3 years, 1891-93.	1893	Average 3 years, 1891-93-
16 American Bronze..	3.0	2.85	55.1	59.10	36.0	46.99
17 Egyptian	2.9	2.71	58.6	61.33	38.2	46.33
18 Jones' Winter Fife	2.4	2.23	58.0	60.47	35.9	43.36
19 Bulgarian	2.2	2 28	61.1	62.37	34.7	42.89
20 Canadian Velvet Chaff ..	2.5	2.42	56.8	58.13	34.0	41.54
21 Garfield or Natural Cross.	2.0	2.46	57.0	59.40	26.6	41.14
22 Winter Pearl...	2.1	2.48	59.7	60.37	30.5	40.71
23 Democrat	2.1	2.31	59.5	61.97	29.3	39.36

These varieties have been grown here for three years, and like those of the previous table, under the same conditions. The average yield obtained from them in 1891 was 55.3 bush. per acre ; in 1892, 39.9 bush. ; in 1893, 33.2 bush. ; for the three years 42.8 bush. The average weight per measured bush. in 1891 was 63.2 lb. ; in 1892, 59.9 lb. ; in 1893, 58.2 lb. ; for the three years, 60.4 lb. The American Bronze, although still at the head of the list, does not seem well able to maintain the relative position which it gained in 1891. Its light weight per bushel and its rust tendencies tell somewhat against it, but it is a vigorous grower and stands up well. The Egyptain, though an old variety, has done very fairly. The Jones' Winter Fife which comes third in point of yield stands higher relatively this year than previously. First class milling properties are claimed for it. The Bulgarian, which bears considerable resemblance to the Democrat, yields fairly and weighs well. The Canadian Velvet Chaff gave a fair yield per acre but the grain was exceptionally light in weight.

Table IV gives yields of 21 varieties for two years :

Varieties.	Straw per acre. (tons.)		Weight per measured bushel. (lb.)		Grain per acre. (bush. 60 lb.)	
	1893.	Average 2 years, 1892-93.	1893.	Average 2 years, 1892-93.	1893.	Average 2 years, 1892-93.
24 Dawson's Golden Chaff,	2.3	2.90	57.4	58.5	38.1	45.66
25 Mediterranean	3.0	3 19	61.0	61.4	30.4	40.65
26 Reliable.	2.1	2.62	60.2	61.2	31.6	39.76
27 Deitz Longberry	1.9	2.63	61.5	61.7	30.2	39.46
28 Coryell....	1.7	2.27	62.7	62 1	31.6	38 89
29 Russian Amber........	2.0	2.59	60.7	61.2	29.0	37.83
30 Rutherford	1.8	2.73	58.2	59.0	29.1	37.64
31 Red Wonder	1.7	2.94	61.2	62.0	25.7	37.26
32 Walker's Reliable	2.1	2.39	59.6	60.0	31.3	37.08
33 Fulcaster..............	1.5	2.39	61.2	62.9	23.4	36.94
34 Rumsey	1.8	2.57	59.7	60.6	27.5	36.30
35 Valley	1.8	2.19	58.7	60.1	26.1	34.90
36 Longberry Red	1.7	2.53	60.0	60.5	27.2	34.79
37 Fultz..................	1.2	2.14	60.9	61.7	20.0	33.72
38 Velvet Chaff	1.5	2.26	60.7	61.9	26.1	33.30
39 Genesee	1.5	2.47	58.5	59.8	22.1	32.94
40 Monette	1.5	2.41	58.0	58.5	22.7	32 38
41 Hybrid Delhi	1.2	2.04	56.1	57.8	19.5	31.17
42 Manilla	1.5	2.54	54 0	56.4	22.1	30.34
43 Scott.....	1.5	2.08	57.8	59.4	22.9	27.71
44 Red Russian	.8	1.99	56.1	58.8	7.9	24.64

The varieties in Table IV have been grown here for but two years. Considerably more than half the number were imported from the United States. The average yield per acre in 1892 was 44.7 bush. ;

in 1893, 25.9 bush.; for the two years, 35.3 bush. The average weight per measured bushel was 61.3 lb., and in 1893, 59.8 lb.; for the two years, 60.5 lb. The Dawson's Golden Chaff, originated in 1881, by Robt. Dawson of Paris, Ont., comes first in point of yield. It is exceptionally strong in the straw, but has some rust tendencies. The average yield per acre for two years has been 5 bush. in advance of the variety next on the list. The old Mediterranean, imported from the United States, comes second in point of yield, showing that it still retains its old time vitality. The Coryell, previously mentioned as one of the three earliest varieties, gave the heaviest weight per measured bushel of the 52 varieties grown in 1893.

Table v gives yields of 8 varieties for one year only:

Varieties.	Straw per acre 1893. (tons.)	Weight per measured bushel, 1893. (lb.)	Grain per acre 1893. (bush. 60 lb.)
45 South Sea	1.1	60.0	31.0
46 White Leader	1.7	54.6	30.1
47 Eureka	1.9	56.1	27.7
48 Soule's	1.9	54.0	26.2
49 Stewart's Champion	2.5	56.	25.8
50 White Star	.9	58.8	25.1
51 Treadwell	1.2	57.1	16.5
52 British Columbia	1.5	53.3	15.0

The eight varieties in table v were grown here this year for the first time in these comparative tests. None of them have given very high yields. The South Sea variety bears a very close resemblance to the Seneca or Clawson, insomuch that they be one and the same sort. The White Leader, very recently introduced, stands second in point of yield. It is one of the lightest weighing wheats in the list of varieties mentioned in the above table. The Soules and Treadwell will be remembered as old standard varieties. The behavior of neither of them was such as to sustain the old time prestige, more especially the Treadwell, with which the yield was very low.

Table VI gives comparative summary of results:

Classes of grain.	Number of varieties.	Average yield of straw per acre. (tons.)		Average weight per measured bnshel. (lb.)		Average yield of grain per acre. (bush. 60 lb.)	
		1893.	Average 2 years, 1892-93.	1893.	Average 2 years, 1892-93.	1893.	Average 2 years, 1892-93.
Bald	24	2.24	2.77	57.8	58.7	31.0	35.6
Bearded	20	2.14	2.66	60.0	60.8	30.8	38.2
White Chaff	30	2.15	2.66	58.7	59.6	29.9	36.1
Red Chaff	14	2.30	2.83	58 9	59 8	33.0	38.3
White wheat	15	2.10	2.67	57.8	58.7	30.7	35.3
Red wheat	29	2.24	2.74	59.3	60.2	31.0	37.5

It will be observed that the average per measured bush. of the 20 bearded varieties for two years was 2.1 ℔. more than that of the 24 bald varieties. The 29 varieties of red wheat weighed on an average 1.5 ℔. per measured bushel more than the 15 varieties of white wheat. During the two years the bearded varieties gave an average yield of 2.6 bush. per acre more than the bald varieties; the red chaff varieties 2.2 bush. per acre more than those with white chaff; and the red wheats 2.2 bush per acre more than the white wheats. These years have not been really first-class wheat years, and this doubtless has had an important bearing on these results.

TABLE VII gives yields of four varieties of Winter wheat sown at four different dates:

Dates of seeding.	Weight of grain per measured bushel. (℔.)				Yield of grain per acre. (bush. 60 ℔.)			
	Dawson's Golden Chaff.	Early Red Clawson.	American Bronze.	Surprise.	Dawson's Golden Chaff.	Early Red Clawson.	American Bronze.	Surprise.
August 26th	57.5	57.3	57.8	57.3	31.1	26.3	24.2	22.3
September 2nd	57.3	56.1	57.5	55.8	28.6	19.4	24.4	15.3
September 9th	55.3	55.8	55.6	54.3	25.8	21.5	20.8	15.1
September 17th	48.8	50.1	47.8	49.8	15.1	14.3	10.9	10.8

In the above table four leading varieties of winter wheat were sown at different dates, to test the effect upon the yields. It will be noticed in almost every instance the first date of seeding, viz.: 26th August, gave the best yields, and that these yields decreased, generally speaking, with each seeding, at a later period. These results may have been influenced by the soil, which had grown grain for two years previously. It should also be borne in mind that latitude has much to do in determining the best season at which to sow winter wheat. The varieties in this list have given the following average yields per acre from all the different dates of seeding, viz: Dawson's Golden Chaff, 25.1 bush.; Early Red Clawson, 20.4 bush.; American Bronze, 20.1 bush., and Surprise, 15.9 bush. The average yields per acre from the different dates of seeding are as follows: August 26th, 26 bush.; September 2nd, 21.9 bush.; September 9th, 20.8 bush., and September 17th, 12.8 bush. The average weight per measured bushel at the above dates was as follows: August 26th, 57.5 lb.; September 2nd, 56.7 lb.; September 9th, 55.3 lb., and September 17th, 49.1 lb.

DISTRIBUTION OF SEED.

No varieties of winter wheat are kept for sale this year at the Experiment Station.

In the subjoined table will be found the different sets of varieties of wheats which will be sent free by mail, in half-pound lots of each variety, to farmers applying for them, who will be able to test them carefully and report the results after harvest. The seed will be sent out in the order of the applications received so long as the supply lasts.

Two Sets of Winter Wheat for Co-operative Tests.

I.	II.
Dawson's Golden Chaff.	Dawson's Golden Chaff.
Golden Drop.	Surprise.
Early Red Clawson.	Jones' Winter Fife.
Bulgarian.	White Leader.
American Bronze.	Early Genesee Giant.

Each farmer wishing one of these sets will please write to the Secretary, C. A. Zavitz, Experiment Station, Guelph, *mentioning which set he desires*, when the grain, with instructions for testing and blank forms on which to report will be forwarded free of cost to his address, until the limited supply becomes exhausted.

CONCLUSIONS.

The results of the experiments may thus be summarized :

1. That the average yields per acre of the 52 Canadian and American varieties grown in 1893 were straw 1.9 tons, grain 30 bush., and weight per measured bushel, 58.2 lb.

2. The five best yielding varieties for 1893 were the following : Golden Drop, 42.7 bush. per acre ; Surprise, 42.6 bush. ; Golden Cross 41.5 bush ; Hybrid Mediterranean, 40.6 bush., and Early Red Clawson 40.3 bush.

3. The five varieties which gave the heaviest weights per measured bush in 1893 were the Coryell, 62.7 lb. ; Deitz Longberry 61.5 lb. ; Fulcaster, 61.2 lb ; Red Wonder, 61.2 lb., and Bulgarian 61.1 lb.

4. That in our experience of the past four years, the average yields per acre of the white and red wheats have been almost exactly the same

5. That in our experience of the past three years we have found that the red wheats average from 1½ to 2 lb. more per measured bushel than the white wheats.

6. That in our experience the past year, in sowing varieties of wheat at different dates, we have found that in every instance the earlier sown plots have given the best results.

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WEEDS OF ONTARIO.

BY J. H. PANTON, M.A., F.G.S., PROFESSOR OF NATURAL HISTORY AND GEOLOGY.

For some time past the writer has been collecting information regarding the weeds of Ontario with special reference to their distribution in the province. Having received replies from over one thousand persons to whom circulars were sent through the medium of the Bureau of Industries asking for the names of the ten worst weeds in the district he is able to give in this bulletin a summary of the information received.

Weeds of late years have received considerable attention not only from students of botany but also from practical agriculturists, a fact which indicates that farmers are advancing and that they are departing from careless methods of cultivation, and adopting systems in which cleanliness of the field forms an important factor. In fact they are now convinced that weeds must be classed with such enemies as parasitic plants and insects.

Insects, mildews, blights, etc., were early condemned as sources of loss, but farmers have been slow to consider that much loss could be sustained by growing weeds. However, they see now that weeds involve extra labor, smother useful plants, take food from the soil, add impurities to the grain, rob the soil of moisture, afford shelter and food to injurious insects, and give fields an unsightly appearance.

In Bulletin LXXXV the principles which underlie a successful warfare against weeds were thoroughly discussed and reference was made to the best methods for destroying the following eleven varieties: Canada Thistle, Sow Thistle, Wild Flax, Pigeonweed, Ragweed, Couch Grass, Ox-eye Daisy, Burdock, Blueweed, Mustard and Wild Oat. In this bulletin we give a description of four additional weeds which, though not now so common, may soon become pests.

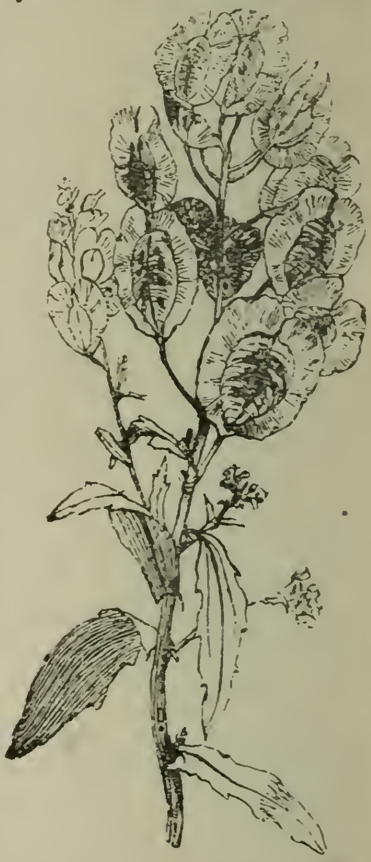
In examining the various lists we find reference made to 92 species, embracing 76 genera and 28 orders. Only a few observers refer to certain forms, but in order to give some idea of the number of plants considered as weeds, a tabulated statement is given which will be useful for showing in a concise form the weeds of Ontario.

So varied are the names given to some weeds that the writer in several cases had to secure the seed and grow the plant or get the plant itself before the local name reported could be understood. Taking the names given in the 1,015 replies we find the 25 following weeds are ranked as the worst, the figures given indicating the number of persons who gave the above in their list of the 10 worst weeds:

Canada Thistle	1,015	Foxtail	152
Mustard	666	Pigweed	126
Wild Oat	472	Black Bindweed	112
Ox-eye Daisy	463	Milkweed	98
Burdock	439	Sorrel	92
Couch Grass	401	Purslane	82
Ragweed	303	Blueweed	79
Wild Peas	288	Mullein	69
Cockle	241	Mayweed	60
Dock	232	Lamb's Quarters	55
Redroot	217	Sow Thistle	50
Bur	212	Bindweed	46
Wild Flax	173		

Penny Cress.

Penny Cre *Thlaspi Arvense* is not yet a common weed in our province, but we may reasonably expect to find it get a firm foothold if its approach is not carefully guarded. It is very common in the Red River valley of Manitoba where it is called the French weed, and as much wheat is being imported from that country this plant will certainly come in the seed. Already it has been found in several parts of Ontario. It belongs to the mustard family and like the other members of it, produces many seeds which are endowed with much vitality. The pods of this plant are very characteristic, being somewhat circular and flat with a distinct notch at the top. The leaves are oblong, arrow shaped at the base, toothed and smooth. It bears very small white flowers. It is an annual, about one foot high and emits a strong somewhat offensive odor when bruised. The method followed in destroying mustard may be adopted to get rid of this pest and exercise vigilance to keep it from getting a foothold. The accompanying cut will prove useful in identifying this new-comer.



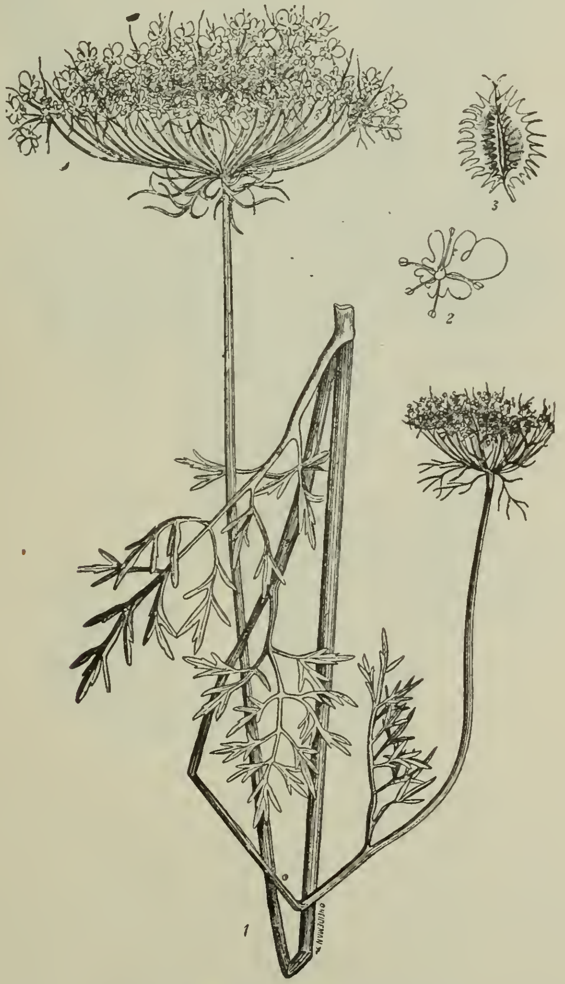
Penny Cress (*Thlaspi Arvense*).

Tumbling Weed.

Another weed that we may expect from the west is known as Tumbling Weed (*Sisymbrium Sinapistrum*), also a member of the mustard family. It is reported by Prof. Fletcher as common around Indian Head, N. W. T. This annual is about two feet high, bears many pods, each well filled with small round brown-colored seeds. It matures its seed about the same time as mustard. Great care should be taken to prevent the plant getting a foothold in Ontario. It is not a native of the Northwest Territory but seems to have been introduced there. It is a native of Europe.

Wild Carrot.

The Wild Carrot (*Daucus Carota*) is a degraded form of the cultivated carrot and, like it, is biennial. It grows about two or three feet high and bears many flower clusters which, as they mature, form a sort of bird-nest structure with each umbel. Being a biennial it

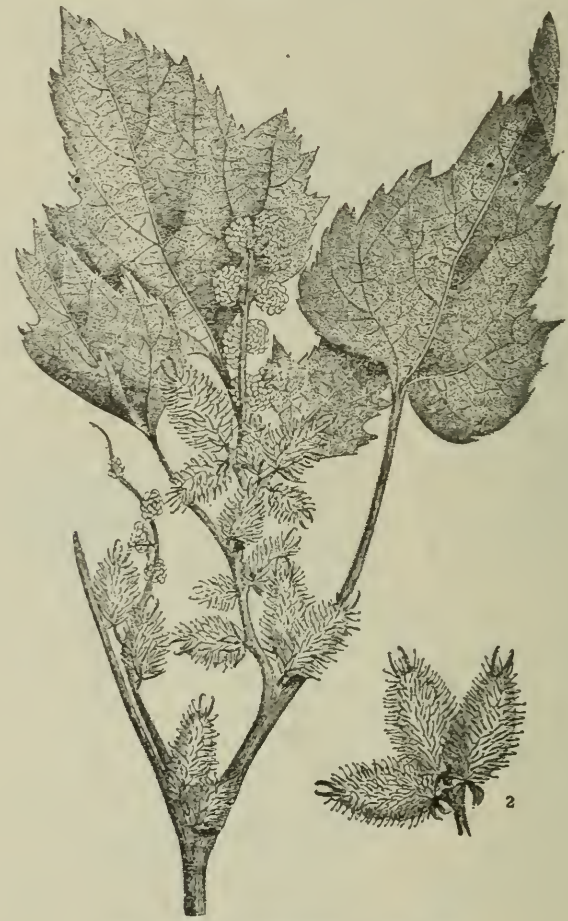


WILD CARROT (*Dancus Carota*).

cannot survive long where thorough cultivation is carried on, and hence is most frequently found along roadsides, railway tracks, etc. Hand pulling and destroying as fast as it reaches flower will be effective. Spudding a few inches below the surface will kill it, but cutting it at the surface has a tendency to make it increase the number of its branches.

Clot-bur.

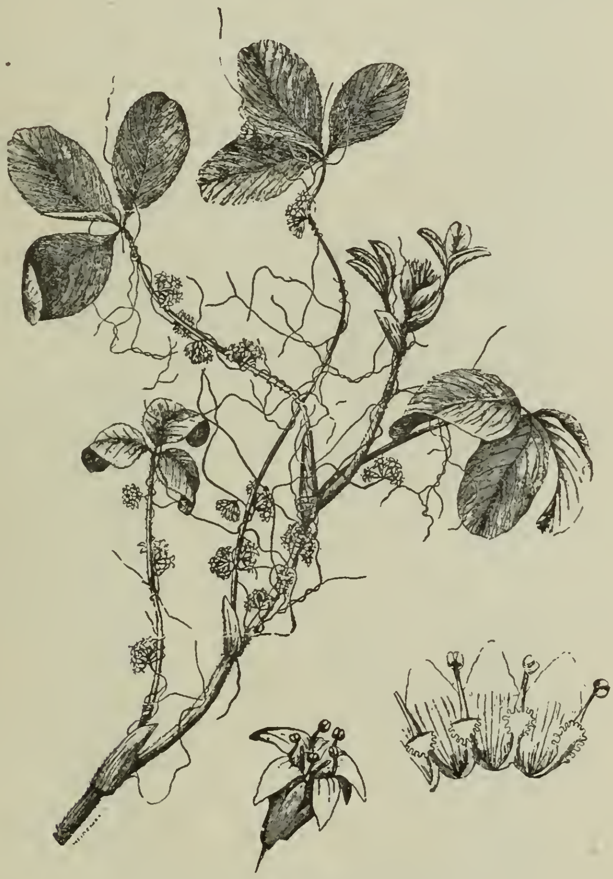
Clot-bur (*Xanthium Canadense*) is a large coarse annual reported from the western part of the province. It bears some resemblance to the burdock in having large coarse leaves and the seed in a bur. The bur is oval, about an inch long and covered with stiff hooked prickles. Like Ragweed it has two kinds of flowers —staminate at the summit in spike clusters and pistillate below. The plant is about three feet high. *Xanthium Spinosum*, a very thorny form, is found in the vicinity of Dundas, but it is more confined to the Southern States where it is a very obnoxious weed.



Clot-bur (*Xanthium Canadense*).

Dodder.

The Dodder (*Cuscuta Trifolii*) is a parasitic plant, an annual which is found twining around the stem of clover. Some specimens were received for identification from the vicinity of Drayton. The seeds of the dodder are sometimes found among clover seed. When these are sown they germinate and reach the clover plants around which they twine and send out from all parts of their stem rootlets that penetrate the clover stems and absorb sap from them and soon weaken the plants upon which they grow. The dodder stem as soon as it gets a firm hold of the clover breaks away from the seed from which it started and lives entirely upon the clover as a regular parasite. When found attacking clover the plants affected should be removed. It is easily recognized as a yellow, leafless, string-like plant twining around the clover. Care should be exercised to sow clean clover seed. Dodder seeds though similar to clover seed are smaller and may be screened. In Europe this parasite is often injurious. The specimens which have come under the writer's



Dodder (*Cuscuta Trifolii*).

observation were attached to stems of lucerne in one case and clover in another; the latter were sent from the vicinity of Drayton and it would appear that this weed is being introduced into some parts of the province. Every precaution should be taken by farmers to prevent its distribution.

In the following tabulated list of weeds we find the Mustard family supplies 7; Pink, 6; Bean, 5; Sunflower or Composite, 22; Figwort, 4; Bur, 4; Mint, 3; Buckwheat, 6, and the Grass, 6. The other orders or families are represented by only one or two forms.

A TABULATED LIST OF THE MOST COMMON WEEDS IN ONTARIO.

Order.	Scientific name.	Common name.
Ranunculaceæ	Ranunculus acris	Buttercup .... P
"	Ranunculus scleratus	Cursed Buttercup ..... A
Cruciferæ	Camelina sativa	False Flax .... A
"	Capsella Bursa-pastoris	Shepherd's purse ...... A
"	Lepidium Virginicum	Pepperwort .... A
"	Thlaspi arvense	Pennycress .... A
"	Brassica Sinapistrum	Wild mustard .... A
"	Sisymbrium officinale	Hedge mustard .... A
"	Erysimum cheiranthoides	Worm-seed mustard .... A
Papaveraceæ	Chelidonium majus	Celandine .... P
Hypericaceæ	Hypericum perforatum	St. John's wort .... P
Caryophyllaceæ	Lychnis Githago	Corn Cockle .... A
"	Lychnis vespertina	White Cockle .... B
"	Silene inflata	Bladder Campion .... P
"	Cerastium arvense	Field Chickweed .... P
"	Saponaria officinalis	Bouncing Bet .... P
"	Stellaria media	Chickweed .... A
Portulacaceæ	Portulaca oleracea	Purslane .... A
Malvaceæ	Malva rotundifolia	Mallow .... P
Anacardiaceæ	Rhus venenata	Poison Sumach .... P
"	Rhus toxicodendron	Poison Ivy .... P
"	Rhus radicans	Climbing Ivy .... P
Leguminosæ	Trifolium arvense	Rabbit-foot clover ..... A
"	Vicia Cracca	Wild Tare .... P
"	Medicago lupulina	Black Medick .... A
"	Melilotus alba	Sweet clover .... A
"	Melilotus officinalis	Yellow Melilot .... A
Umbelliferæ	Daucus carota	Wild Carrot .... B
"	Conium maculatum	Poison Hemlock .... B
"	Pastinaca sativa	Wild Parsnip .... B
Onagraceæ	Œnothera biennis	Evening Primrose ...... B
"	Epilobium angustifolium	Willow-herb .... P
Crassulaceæ	Sedum acre	Mossy Stone-crop ...... P
Dipsaceæ	Dipsacus sylvestris	Teasel .... B
Compositæ	Senecio vulgaris	Groundsel .... A
"	Ambrosia artemisiæfolia	Ragweed .... A
"	Leucanthemum vulgare	Ox-eye Daisy .... P
"	Achillœa millefolium	Yarrow .... P

NOTE.—A is for annual, B for biennial and P for perennial.

WEEDS IN ONTARIO—*Continued.*

Order.	Scientific name.	Common name.	
Compositæ	Tanacetum vulgare	Tansy	P
“	Solidago Canadensis	Golden Rod	P
“	Rudbeckia hirta	Cone-Flower	B
“	Centaurea Cyanus	Bluebottle	A
“	Sonchus oleraceus	Sow Thistle	A
“	Sonchus arvensis	Corn Thistle	P
“	Erechthitis hieracifolia	Fireweed	A
“	Arctium Lappa	Burdock	B
“	Cichorium Intybus	Chicory	P
“	Taraxacum officinale	Dandelion	P
“	Erigeron Canadense	Fleabane	A
“	Anthemis Cotula	Mayweed	A
“	Anthemis arvensis	Field Chamomile	A
“	Cnicus arvensis	Canada Thistle	P
“	Cnicus lanceolatus	Bull Thistle	B
“	Bidens frondosa	Bur Marigold	P
“	Inula Helenium	Elecampane	P
“	Xanthium Canadense	Clot-bur	A
Scrophulariaceæ	Verbascum Thapsus	Mullein	B
“	Veronica arvensis	Speedwell	A
“	Veronica peregrina	Neckweed	A
“	Linaria vulgaris	Toad Flax	P
Verbenaceæ	Verbena hastata	Vervain	P
Labiatæ	Leonurus Cardiaca	Motherwort	P
“	Nepeta Cataria	Catnip	P
“	Brunella vulgaris	Self-Heal	P
Borroginaceæ	Echinospermum Lappula	Stickseed	B
“	Cynoglossum officinale	Hound's Tongue	B
“	Echium vulgare	Blueweed	B
“	Lithospermum arvense	Pigeonweed	A
Solanaceæ	Datura Stramonium	Thorn-Apple	A
“	Physalis viscosa	Ground Cherry	P
Convolvulaceæ	Convolvulus arvensis	Bindweed	P
“	Cuscuta trifolii	Dodder	A
Asclepiadaceæ	Asclepias Cornuti	Milkweed	P
Plantaginaceæ	Plantago major	Plantain	P
“	Plantago lanceolata	Rib-grass	P
Chenopodiaceæ	Chenopodium album	Lamb's Quarters	A
“	Chenopodium capitatum	Strawberry Blite	A
Amarantaceæ	Amarantus retroflexus	Pigweed	A
Polygonaceæ	Polygonum aviculare	Goose Grass	A
“	Polygonum Convolvulus	Black Bindweed	A
“	Polygonum Persicaria	Lady's Thumb	A
“	Rumex Acetosella	Sorrel	P
“	Rumex crispus	Common Dock	P
“	Rumex obtusifolius	Bitter Dock	P
Urticaceeæ	Urtica dioica	Nettle	P
Liliaceæ	Allium tricoceum	Wild Leek	P
Gramineæ	Bromus secalinus	Chess	A
“	Setaria glauca	Foxtail	A
“	Panicum Crus-galli	Barnyard Grass	A
“	Panicum capillare	Witch Grass	A
“	Avena fatua	Wild Oat	A
“	Agropyrum repens	Couch Grass	P
28 Orders.	76 genera.	92 species.	

ONTARIO AGRICULTURAL COLLEGE.

BULLETIN XCII.

DISEASES AFFECTING THE GRAPE

By J. H. Panton, M.A., F.G.S., Professor of Natural History and Geology

ALSO SPECIAL BULLETINS.

APPLES	By D. W. Beadle, Toronto.
STRAWBERRIES ...	By W. W. Hilborn, Leamington.
PLUMS	By G. W. Cline, Winona.
FRUIT STATISTICS.	Bureau of Industries.

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DISEASES AFFECTING THE GRAPE.

By J. H. Panton, M.A., F.G.S., Professor of Natural History and Geology, Ontario Agricultural College, Guelph, Ont.

Having received replies from 551 persons to whom circulars were sent through the medium of the Department of Agriculture for information regarding diseases affecting the grape, the writer is able to present a summary of these replies, and, as the time is now opportune, give a description of four of the most common parasitic plants attacking the grape, and also give information as to the best means to prevent the spread and effect of these diseases.

Of the correspondents making returns, 120 report Downy Mildew, 105 Powdery Mildew, 106 Black Rot, and 14 Anthracnose.

The county of Welland reported 60 per cent. loss, Wentworth 70 per cent., Lincoln 75 per cent., and Essex 50 per cent.

As to varieties most liable to attack, 116 correspondents report Rogers' hybrids, 35 Concord, 23 Clinton, 20 Niagara, 15 Brighton, and 12 Delaware.

The year 1889 is frequently referred to as the season when these diseases were first noticed to any considerable extent, and they have been on the increase since. Grape growers are awakening to the importance and necessity of fighting these foes, as may be seen from the fact that of those in communication with the Department in reply to the circular above referred to, 59 report using sulphur, 45 Bordeaux mixture, 12 copper sulphate, 10 ammoniacal solution of copper sulphate, and 3 eau celeste. The consensus of opinion is that favorable results followed the use of the above name fungicides, especially in the case of the Bordeaux mixture.

Thirty-two persons report that they found farmyard manure to favor the development of these fungoid pests. Many find ashes an excellent fertilizer for the grape vine.

Fungoid Pests.

The grape being a plant that produces a large amount of foliage and fruit, it is not a matter of surprise that it should have a number of enemies among insects and parasitic plants. In this Bulletin we wish to direct the attention of readers to four plants that are found affecting the grape injuriously, by deriving their nourishment from it as parasites upon its leaves, canes and fruit.

No group of plants has received more attention, since the establishment of experiment stations, than what is called the fungi, and no investigations have been more productive in practical results than those which have been followed to ascertain the nature and remedy for plant diseases, caused by species of fungi. Until the microscope was discovered and its manipulation simplified, we knew very little concerning the life history of these pests, most of them being exceedingly minute.

GENERAL CHARACTERISTICS OF THE FUNGI.

The fungi include most of these parasites, that commence life from a spore which to some extent corresponds to a seed, the starting point for the higher forms of plant life, as the grape, etc. Spores are exceedingly small, most of them microscopic, have a very thin covering, germinate from no particular point, and have no embryo. Thus you will perceive they differ very materially from a seed, which is visible, has a well defined covering, germinates from a particular point, and contains an embryo, that develops into a plant capable of producing flowers and seeds.

The fungi also differ from other plants in having no green coloring matter (Chlorophyll) in them, and thus cannot elaborate food from inorganic material ; they must derive their food from material elaborated by plants that do possess Chlorophyll. They therefore live on organic matter, some on dead, such as mushrooms, others on living, such as mildews, smuts, etc. The latter are true parasites, and are very injurious by sapping the vitality from the plants upon which they are found. Among these fungi we find four frequently parasitic upon the grape. Before discussing these specific forms, it may be of service to the reader to outline the usual development of a parasitic fungus from the germination of spore till spores are again produced. Spores being exceedingly small are readily transported by the wind, and soon reach a suitable place for germination upon some plant, which is termed the host. The minute germinal thread which at first appears soon penetrates the tissue of the host plant and continues growing among the cells, from the contents of which it derives nourishment. As growth proceeds, thread like structures (*hyphæ*) increase, and usually form quite a complicated mass (*mycelium)* pervading the tissues of the affected plant. The growth of this has a very disastrous effect upon the plant attacked, by lessening its vitality and general growth. At the proper time certain structures arise from the mass (*mycelium).* These vary much in the different fungi ; but all are concerned in the production of spores, which falling upon proper places and surrounded by favorable conditions, soon germinate and perpetuate the disease.

This first form of spore (Summer spore) is usually developed early in the season and in great numbers, their use being the rapid spread of the fungus. Their vitality is chiefly confined to the season in which they are produced ; but later in the season, among the threads of the mass, more complicated structures appear. The elements they contain mingle together and give rise to much more durable spores (Winter spores) which are destined to carry the trouble into another season.

They are capable of surviving more adverse conditions than the summer spores. By burning up affected material in winter or early spring, before the winter spores have germinated, we can prevent to a considerable extent the spread of a fungus. Remembering this outline, for it is much the same in all these parasitic fungi, the reader will be in a position to understand the following descriptions of certain specific forms feeding among the tissues of the grape.

Downy Mildew or Brown Rot (*Peronospora viticola.*)

This fungus which moisture seems to favor, attacks all green portions of the grape and appears about June. As soon as a spore falls upon the leaf, it germinates, and the germinal thread penetrates the tissue and passes between the cells, not into them ; but small growths develop on the penetrating threads and these (*haustoria*) dip into the cells and abstract nourishment for the growing fungus. An examination of these minute threads by a microscope reveals no partitions, such as are observable in the threads of "Black Rot." As development continues the thread-like structures of the fungus increase and form a mass (*mycelium*) which pervades the host-plant ; from this arise minute stalks, that make their appearance through the small openings (*stomata*) on the underside of the leaves, usually several in one opening. (See fig. 1). They appear in such numbers, as to form patches of a mouldy or frost-like appearance ; opposite to these on the upper side of the leaves are pale green spots, which gradually turn brown, indicating a sickly condition of the leaf. These stalks under the microscope present quite a tree-like form as seen in the figure, and bear on the ends of the branches many oval bodies (*conidia*) which drop off as soon as they mature. If they reach favorable conditions, the contents soon break up and spores are formed ; these pass out, each capable of moving about, and after reaching a proper resting

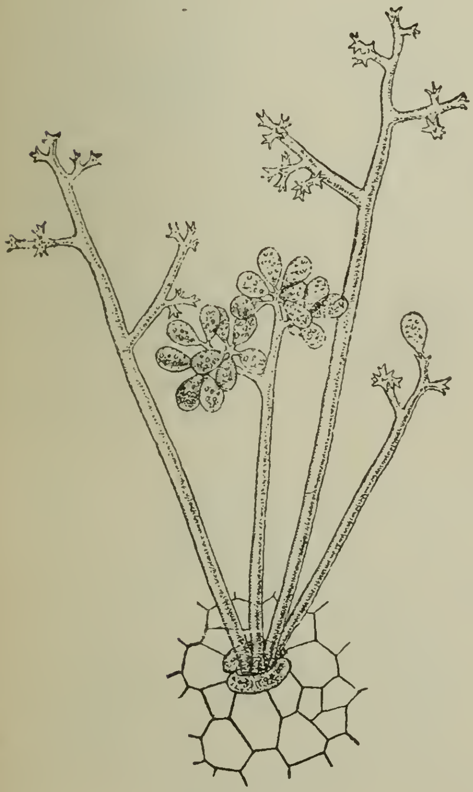


Fig. 1.

place, they germinate and the fungus again develops, as already described. These are summer spores and aid in spreading the fungus rapidly. Later in the season, about autumn, the winter spores are produced among the threads of the mycelium by a sexual process. They have much thicker walls and are fitted to withstand the adverse conditions of winter, and thus carry the trouble into another year. Hence the advisability of destroying leaves, etc., that might be suspected of having these winter spores upon them. When the shoots are attached it is indicated by dark colored spots slightly depressed, but not so deep as in the case of Anthracnose. Affected fruit fails to develop, it gradually becomes withered and brown. (See fig. 2). Hence the term "Brown Rot" applied to distinguish it from "Black Rot." In the latter the berries are very much wrinkled and dried up. (Compare figures A and B).

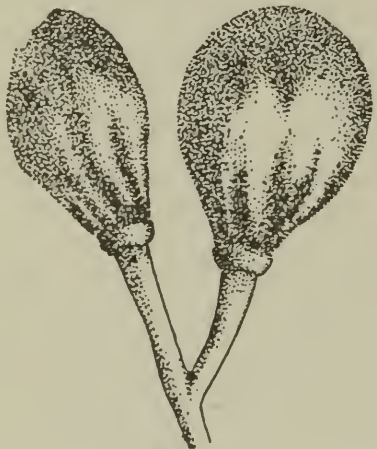
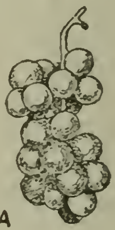
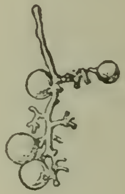


Fig. 2.



A



B

The Downy Mildew in its growth bears a close resemblance to the fungus causing "Potato Blight," described by the writer in the O.A.C. Report for 1886. A great many "blights" on different plants, turnips, lettuce, onion, cabbage, etc., are caused by parasites in the order (*Peronosporeæ*) to which the above belong.

Remedies.—1. Eau Celeste, a mixture of copper sulphate ammonia and sodium carbonate (see under conclusions at the end of this Bulletin) has been used very successfully against Downy Mildew by spraying as follows: 1st. Application ten days before the vines blossom; 2nd. Just after the blossoms fall, and 3rd, about two weeks later. 2. The Bordeaux mixture, copper sulphate, lime and water, as also referred to in the conclusions, is effective.

Black Rot of the Grape (*Laestadia Bidwellii.*)

This fungus, aided by moisture and high temperature, is often associated with rank and succulent growth. It affects leaves, shoots and berries, usually making its appearance in June, in the form of circular reddish brown spots, of lighter color in the centre. They are more distinct on the upper surface of the leaf, than on the lower. Around these diseased parts, minute dark colored pimples can be seen. These show the various stages in the growth of the fungus which we shall describe, when referring to the attack upon the fruit. On the shoots the disease causes long brown spots somewhat depressed. It is not in the attack upon either leaves or shoots that much damage is sustained, but when the fungus reaches the fruit. The berries are attacked shortly after the leaves show the presence of the disease. The trouble often shows itself as a small brownish spot on the surface, near the stem end ; this gradually spreads and covers the whole surface, changing in color, till it becomes quite black and the berry eventually withers, assuming a dry, shrivelled up condition. (See figs. A and B, showing unaffected and affected fruit.) An examination of the surface reveals many small black pimples in which the fungus can be detected ; these pustules can be seen by the eye, but sections of them under the microscope show many interesting stages in the life history of this parasite.

Its thread-like structures with partitions, during development not only grow between the cells, but in some cases penetrate them. Among the tissues of the shrivelled berries minute cavities are seen in which spores are developed. These cavities may be quite near each other, but contain entirely different forms of spores, for we find four kinds connected with the spread of this fungus. When mature the spores escape through minute openings on the surface of the pimples referred to.

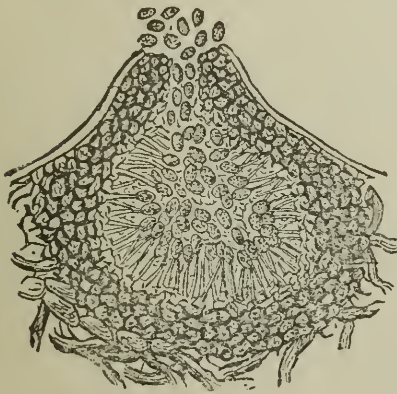


Fig. 3.

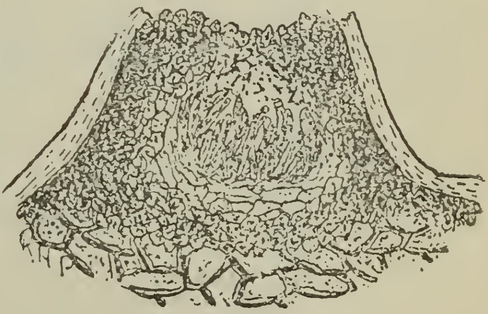


Fig 4.

Among the most important germs in spreading the fungus during summer are the *Stylospores*, oval in outline and borne on very small stalks attached to the walls of certain cavities, (*pycnidia.*) As soon as mature they separate from the stalks and pass out of an opening on the top of a pimple. (See fig. 3.) Other cavities (*spermagonia*) give rise to still smaller and more elongated spores (*spermatia*) which mature and also pass out through an opening.

Ascopores, oval in outline, are not developed till the "rot" has been fully matured, and may be seen upon diseased berries in the spring. They are winter spores and are concerned in the perpetuation of the fungus from season to season. On this account it is very important to destroy them as far as possible. The cavities (*perithecia*) containing these are largely occupied by flask-shaped organs (*Asci*), (See fig. 4) in each of which are eight of these oval spores; these on reaching maturity escape from the cavities to find a new starting point on the plant.

Conidia, a fourth form of spore, are not so common as the others and are more usually found growing upon the surface of the pimples, than in cavities inside; they are oval and appear at the ends of stalks, showing well-marked divisions, from which they drop off, when mature. The *Stylospores* and *Ascospores* are the most important in the propagation of "Black Rot."

REMEDIES. 1. Some have succeeded in preserving the fruit from attack by enclosing the bunches in paper bags, as soon as the flowers are fertilized. 2. Spraying with Bordeaux Mixture (see conclusions) is a very successful fungicide against "Black Rot."

POWDERY MILDEW. *(Uncinula spiralis.)*

This fungus is quite different from either of the preceding in its form and habit; it prefers a dry atmosphere and confines its attack largely

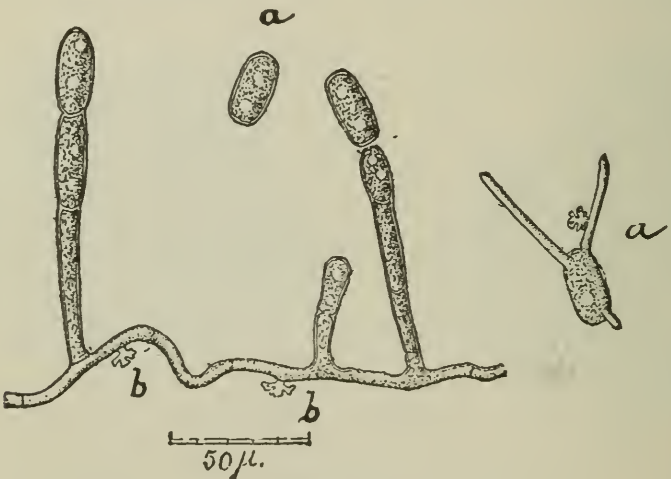


Fig. 5.

to the external portions of the affected parts. It appears about midsummer in the form of grayish white patches on the upper surface of the leaves, sometimes on the shoots and even berries. After it has developed for a time it throws up erect threads, each bearing single spores (*conidia*) at its summit; they drop off, and are followed by others taking their place, (see fig. 5.) and thus keep up a supply of summer spores. When the season advances many peculiar, minute, nutlike structures (*perithecia*) (see fig. 6.) are developed among the threads of the mass (*mycelium*). Within these, in small flask-shaped bodies (*Asci*), the winter spores (*Ascospores*) are developed, to continue the disease another year.

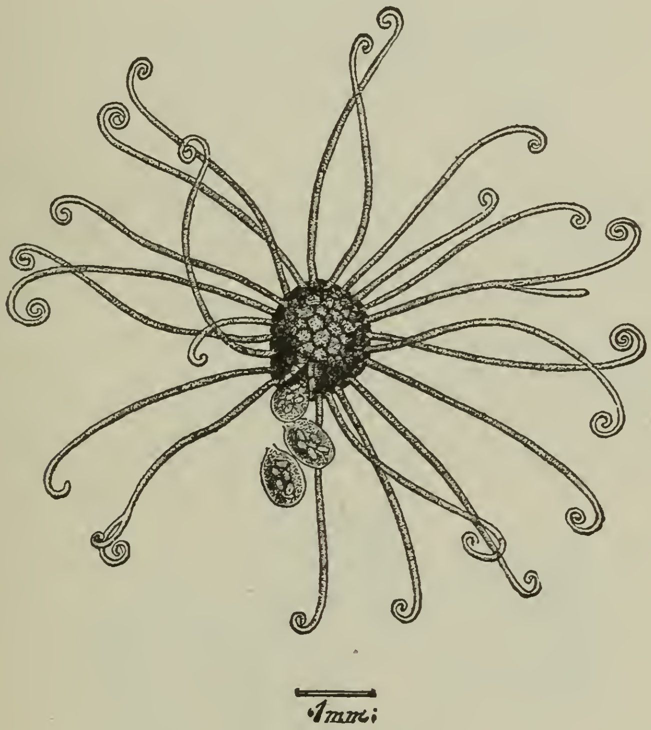


Fig. 6.

Remedies. 1. Sulphur has been very successful against this mildew by applying it, 1st. Twelve days before bloom; 2nd, when the plants are in bloom, and 3rd, three weeks later. 2. Bordeaux Mixture is also successful.

ANTHRACNOSE (*Sphaceloma ampelinum*).

Continued damp weather favors the development of this fungus, which may be found on all green parts, but more especially on the cane where it appears, as small brown marks, which sometimes unite and form somewhat lengthened spots, the centres of which are sunken with a well raised border. The growing fungus does not extend deeply into the tissues, although the central area is depressed ; but the affected parts rupture and spores are produced on the ends of mycelial threads ; these drop off and form new centres of the disease. (See. fig. 7). On the leaves it produces minute brownish spots of lighter color in the centre and raised borders surrounding the whole.

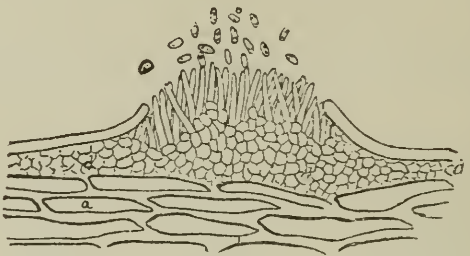


Fig. 7·

When the berries become affected, they show brownish or blackish specks with a more or less circular outline ; the centres of these become gray, and surrounding this sometimes a conspicuous red ring appears with a dark border on the outside of it. This presents such a characteristic appearance, that the term " Bird's-eye Rot," (See fig. 8) has been applied to the disease. Berries attacked do not wither or turn brown as those referred to in " Black Rot " and " Brown Rot " ; but the portion affected becomes somewhat wrinkled, and the berries assume an irregular shape. The spores of this seem to live during the winter upon the diseased portions of fruit, leaves or shoots.

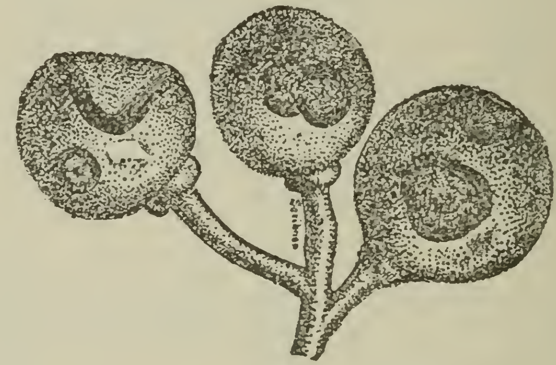


Fig. 8.

Remedies. Sulphur has given good results. But it would be a great improvement to spray the canes wlth a solution of copper sulphate (1 lb. copper sulphate in 20 gals. water) before the buds start. The careful and thorough application of Bordeaux mixture, as directed in the conclusions of this Bulletin, will be followed by but very slight if any attacks upon the grape, by the four parasitic plants discussed.

CONCLUSIONS.

From a study of the nature and habits of the fungi discussed in this Bulletin, we make the following conclusions:

1. Destroy as far as possible all affected material such as diseased leaves, canes and berries.
2. Before the buds start spray with a solution of copper sulphate (1 lb. in 25 gals. water).
3. After growth starts spray once at least before the vines bloom, using Bordeaux mixture (see below); if twice, make the first application as soon as the leaves appear and the second just before blooming.
4. After bloom, as soon as the fruit sets, make three applications at intervals of 12 to 15 days, with the Bordeaux mixture.

The coloring of the berries by this mixture may be overcome by using in the last application an ammoniacal solution of copper carbonate (see below); or it may be removed by dipping the fruit in a solution of vinegar (2 quarts vinegar in 10 gallons water) and then rinsing it in clean water.

5. The best fungicides to prevent the diseases of the grape are (*a*) copper sulphate, 1 lb. in 25 gals. water, for early treatment; (*b*) Bordeaux mixture, 6 lb. of copper sulphate, 4 lb. fresh lime, 45 gals. of water. In making this we grind the copper sulphate and dissolve it in a few gals. of water, slake the lime with about 6 gals. of water; after cooling strain it through some coarse sacking into the barrel that contains the copper sulphate solution and stir it well, adding the rest of the water necessary to make up the mixture; (*c*) eau celeste, 2 lb. copper sulphate, 2½ lb. washing soda, 2 pints ammonia and 25 gals. of water. Dissolve the copper sulphate in 2 gals. of water, the 2½ lb. washing soda in another vessel of water, mix these and when chemical action has ceased add 2 pints of ammonia; (*d*) ammoniacal solution copper carbonate; 3 oz. copper carbonate, 2 pints ammonia, 25 gals. water. Dissolve the 3 oz. of copper carbonate in 2 pints of ammonia, and when about to use dilute with 25 gals. water. Of these the Bordeaux mixture is likely to rank first.
6. These mixtures can be applied with great efficiency by using a Knapsack sprayer with Vermorel nozzle or a barrel pump, drawn upon a stone-boat between the rows.

THE FARMER'S APPLE ORCHARD.

By D. W. Beadle, Toronto, Ont.

Apple trees will grow in a great variety of soils, yet will give the best results when grown in a well drained, calcareous (lime) loam. A northern exposure is preferable to a southern one, and high ground to low land.

Trees four years old from the bud or graft bear transplanting better than those that are older ; at five years after being set in the orchard they will be better trees than those that are much older when planted. They will yield better flavored and higher colored fruit when planted well apart, ordinarily forty feet each way is the proper distance. Plenty of sunlight and free circulation of air, are essential to the healthy development of the foliage, in which the processes of assimilation are carried on ; in addition the conditions are not so favorable to the growth of the fungus, *fuscicladium dendriticum*, which causes the well-known apple scab.

Pruning.

Every spring the orchard should be carefully examined before the weather has become warm enough to start the sap, and the trees pruned with a knife wherever needed to prevent the head from becoming too dense. If properly pruned it will rarely be necessary to use any other instrument ; the cutting off of large limbs should be averted by removing them when small. When it is necessary to take off a large limb, the better plan is to cut away only a part of it each spring, thereby lessening the size of the final cut in its proportion to the size of the trunk, thus enabling the tree to heal in less time.

Varieties.

The varieties to be planted for home use will depend somewhat upon personal preferences, and much upon the conditions in which the planter is placed. It is advisable before deciding upon the kinds, to examine the bearing orchards of the vicinity, and make choice among those that do well in similar soil, exposure and temperature.

The following varieties are named about in the order of ripening : Yellow Transparent, Red Astrachan, Oldenburg, Chenango, Gravenstein, Ribston Pippin, Blenheim Pippin, Snow apple, Tompkins

King, McIntosh, Tolman Sweet, Sutton Beauty, Baldwin, Pewaukee, Northern Spy, Grimes' Golden, Golden Russet, Roxbury Russet. A selection can be made from these adapted to a very considerable part of the Province.

In planting for market, selection can be made with advantage from Oldenburg, Gravenstein, St. Lawrence, Ribston Pippin, Wealthy, Blenheim Pippin, Tompkins King, Baldwin, Northern Spy, Golden Russet, Ontario, Roxbury Russet, R. I. Greening and Westfield, Seek-no-further. When planting a commercial orchard it is important to avoid a multiplicity of varieties, and yet not to plant a very large number of any of the following in a block by themselves, for the reason that they are self-sterile; that is, the pollen does not fertilize its own blossoms: Gravenstein, Tompkins King, Northern Spy, Red Astrachan, Roxbury Russet, Tolman Sweet; these are self-sterile. The Baldwin and R. I. Greening are self-fertile.

Those intending to plant an orchard for commercial purposes will do well to plant with an eye to the British market, for often that will be our best market, and fruit that will command a high price there will sell in any market. The following varieties when well grown, free from scab and all other imperfections, including worms, well graded, honestly and neatly packed, will always command a high price.

The Oldenburg, if picked before it shews any yellow and after it has put on its bluish color, ships well, if properly handled, and arrives there in prime condition. The next in season is the Gravenstein, and it commands the very highest price, next the Saint Lawrence, and close upon it the Ribston Pippin, which when prime sells there for over twenty shillings sterling per barrel. The Blenheim Pippin rivals the Ribston in price. These two varieties when prime will always sell there at high figures. Hitherto the Baldwin has been a profitable apple to send to the British market, and sells well, especially when high colored. Yet it is very questionable whether it will maintain its position, because of its lack of high quality. The Rhode Island Greening is gaining in favor there bidding fair to outstrip the Baldwin before long. Tompkin's King is much esteemed and sells at high figures. The Northern Spy when well grown is also much esteemed in its season.

SPRAYING.

The fungus that causes the apple-scab has become so very abundant and so widely diffused, that it is important to act energetically and persistently in the use of the most efficient means for preventing it from getting in its injurious work. Unless this is done a large share of many of our very valuable apples will often be unfit for market. The point to be aimed at in this warfare is to kill the fungus spores before they have commenced to grow. As at present advised the most efficient means of doing this is to spray the trees in the spring, once before the buds burst and again just as they begin to unfold, and before the flowers open, with *modified eau celeste*; after the blossoms have fallen to spray them twice with *Bordeaux mixture*, to which Paris green has been added in the proportion of ¼ lb. to 50 gallons of the mixture. If the weather is dry, an interval of ten days to two weeks may intervene between the sprayings made before the blossoms appear and between those after the flowers have fallen; but if it is rainy it will be necessary to spray oftener, even to giving a spraying every week, making three with the *eau celeste*, and three with the Bordeaux mixture and Paris green.

Modified eau celeste is made by dissolving two pounds of copper sulphate (blue-stone, blue vitriol) in hot water, say two gallons. Do not use an iron or zinc vessel. A convenient way will be to put the blue stone into a water-tight barrel and pour the hot water upon it, and stir with a stick occasionally until it is all dissolved. In another vessel, no matter of what it is made, dissolve one pound and a half of carbonate of soda (common washing soda), in say a gallon of water, cold or hot as is most convenient. When both of these have become wholly dissolved, pour the soda solution into the barrel containing the solution of blue vitrol. When the chemical action which will now ensue has ceased, pour into the barrel one quart of ammonia of the strength of 26°, and stir the liquid. In a short time there will be a clear blue solution. Now add enough water to bring the whole up to thirty-two gallons. If convenient to use rain water it is preferable.

Bordeaux mixture is made by dissolving six pounds of copper sulphate in say five gallons of hot water. Take four pounds of fresh caustic lime, adding water enough to make a thin white-wash; fasten a piece of coarse sacking over the barrel containing the solution of blue-stone, and strain the thin white-wash into it. When this is done add enough water to bring the whole up to forty gallons. The cost of this will not exceed one and a half cents per gallon. It is necessary to add the lime in order to prevent the copper sulphate from injuring the foliage.

In order to kill the apple worms before they have time to eat their way into the apples it is necessary to add Paris green to poison the worms. The proportion that is advised is at the rate of one pound of Paris green to two hundred gallons of water. This would require six and two-fifths ounces of Paris green to be added to the forty gallons of Bordeaux mixture. Six ounces, however, will be found to be sufficient. By thus combining the poisonous Paris green with the copper sulphate, we are able to kill two birds with one stone; to prevent the fungus from making the apple scabby and the young worms of the codling moth from spoiling the fruit.

In order to throw the spray upon the trees it is necessary to have a force pump made for the purpose. This should be of sufficient capacity to enable the operator to work without severe fatigue, for at best it is hard work. The cylinder should be not less than two and a half inches in diameter, with a stroke of five inches in length, and the handle long. It is also important that the working parts should be of brass, or at least brass lined, for the action of the chemicals soon corrodes the iron. When spraying with the Bordeaux mixture, or with Paris-green, it is very important to keep the liquid constantly stirred so that the lime and Paris-green may not settle at the bottom. One spraying pump is provided with a small pipe, through which a continuous stream is forced against the bottom of the barrel by the pressure from the air chamber, to keep the lime or Paris green, or both when used together well suspended in the water. Whether this result is attained satisfactorily, the writer is unable to say, never having used or seen one in operation.

The best nozzle is that known as the Vermorel nozzle. It is provided with a spindle which can be thrust forward by pressing the thumb upon a button to clear the vent from any obstruction, and which is drawn back by a spring the instant the thumb is removed. This nozzle produces the finest vapor spray, and does not use up half as much liquid to cover a given surface, as other nozzles. The spray can be thrown with this nozzle a distance of fifteen feet, not more; but a solid stream can be thrown a distance of forty feet, when such a stream is required, by unscrewing the Vermorel attachment.

After using the pump in spraying, always pump clear water through it and the hose and nozzle; else the lime will harden in the working parts and cause great trouble.

Some Injurious Insects.

If the apple trees are infested with leaf-eating worms, such as the canker worms, *Anisopteryx vernata* and *pometaria*; the yellow-necked caterpillar, *Datana ministia;* the red-humped caterpillar, *Œdemasia concinna;* all such can be poisoned by spraying the trees with Paris green in water in the proportion of one pound of Paris green to two hundred gallons of water. The tent caterpillars, *Clisiocampæ Americana*, are more easily destroyed by capturing them when they are in their tent, where they are sure to be in the early morning, at mid-day if the sun shines bright, and at evening. The fall web-worm, *Hyphantria textor*, keeps within its web until it has nearly attained its full growth and therefore can be easily captured at any time of day. Sometimes the forest tent caterpillar, *Clisiocampa sylvatica*, invades our orchards; when it does it usually comes in countless numbers, and can be best destroyed by spraying with Paris green.

Benefits of Spraying.

The efficacy of the means herein mentioned for preventing injury to our apple trees and apples from the apple scab, the codling moth worm, and leaf-eating caterpillars is no longer open to question. They have been most thoroughly and frequently tested, not by one person only, or in but one locality, but by very many persons, in very many places and under a great variety of circumstances; all testifying to decidedly beneficial results which abundantly compensate for all cost of labor and material. The results obtained by spraying an orchard of Tompkins King last season, 1893, as stated by Mr. E. G. Lodeman, are here given as one of many instances that might be mentioned. The material used was the Bordeaux mixture. Some of the trees were sprayed only twice, namely May 19th and June 8th; others four times, April 26th, May 19th, June 8th, and June 22nd; and yet others six times, April 26th, May 19th, June 8th and 22nd, July 13th and August 1st. On April 26th the buds were swollen almost ready to burst, on May 19th a few blossoms still remained on the trees, on June 22nd the young apples were set. At this date Paris green was added to the Bordeaux mixture, and used in this and all subsequent sprayings. The proportion of Paris green was equivalent to one pound in two hundred and fifty-six gallons of water, or two and a half ounces to the fourty gallons of Bordeaux mixture. The apples were gathered about the middle of September, the fruit from each tree piled by itself, and divided into three grades; the first of entirely fancy fruit, only strictly first class apples put into it; the second of symmetrical and even large apples of good color, if several, even small, spots could be found on their surfaces; the third averaged as good as the ordinary barrelling apples of the country. From the trees sprayed only twice, 55 per cent. were first grade, 43 per cent. second, and 2 per cent. third; with 11 per cent. wormy. It will be remembered that the trees sprayed only twice received their sprayings before the codling moth would have laid many, if any, eggs. The trees sprayed four times gave 53 per cent. first grade, 46 per cent. second, 1 per cent. third, with 6 per cent. wormy. Those sprayed six times yielded 76 per cent. first grade, 19 per cent. second and 5 per cent third, with 4 per cent. wormy. The trees left without spraying, for the sake of comparison, gave 25 per cent. first grade, 56 per cent. second, 19 per cent. third, with 9 per cent. wormy. The gain from two sprayings was 120 per cent., from four was 112 per cent., from six 204 per cent. of strictly first-class fancy fruit. The apples were subsequently sold, consisting of 65 barrels, the buyer graded them thus: 59 barrels firsts, 4½ seconds, and 1½ thirds; that is, he made 91 per cent. firsts, 7 per cent. seconds, and 2 per cent. thirds; whereas Mr. Lodeman makes his highest percentage of firsts only 76 per cent., which was from the six sprayings; while the average of the whole, the two, the four and the six sprayings, is 61.3 per cent. The difference between this and 91 per cent., as graded by the buyer, indicates the high standard of Mr. Lodeman's grading.

The small size of many of the farm orchards and the multiplicity of varieties of which most of these is composed, together with the pressure of other farm work in spring, may make the spraying of orchards seem an added burden too great to be taken up for the amount of gain. This, however, might be overcome by a number of farmers that live contiguous to each other combining for this purpose, uniting in the purchase of the requisite outfit, and engaging a competent person to prepare the material, do the spraying, and care for the machinery. The amount of liquid required to efficiently spray an orchard of large apple trees will average about four gallons per tree; less will not be sufficient to cover all parts of the tree properly, if more is used the excess will fall to the ground. Two men, one to drive and do the spraying, the other to work the pump, can thoroughly spray at least one hundred such trees in a day.

Again, most farmers wait for a buyer to come and take the fruit at such price as he may think best to offer. This man expects to make a profit sufficient to pay for his time and expenses; the wholesale dealer to whom he ships must have his commission, and if sent to Great Britain the consignee there has his commission. Why not unite also in shipping the fruit direct to the market and thereby save to the producer the profits of at least the travelling buyer?

In closing this paper the writer desires to impress upon the farmers the importance, nay, the absolute necessity of spraying their apple orchards every spring. The apple-scab and the codling worm have been allowed to go unchecked so long that there is not an orchard in the country that is not suffering from the injuries inflicted by these pests. While we were ignorant of the means of preventing these injuries there was no help for it, but now there is no excuse for us if we allow these to continue. It is not only that the apple-scab fungus spoils the apples, but by its great injury to the leaves weakens the trees, so that the fruit which escapes being scabby, does not attain its full size. Nor is the codling worm the only insect injurious to the orchard that the spraying kills. The tussock moth, the yellow-necked and red-humped caterpillars, the canker-worms, the leaf-roller, the leaf-folder, the leaf-crumpler, the very small but very injurious eye-spotted bud-moth, the Palmer-worm, and others that might be named, are usually on hand to add their quota of harm. If we are to secure first-class prices for our apples, we must grow first-class fruit, and there is nothing more certain than the fact that we cannot gather first-class fruit if we do not spray our apple orchards every season.

STRAWBERRY CULTURE

BY W. W. HILBORN, LEAMINGTON, ONT.

It is doubtful whether there is a farm in Ontario on which strawberries cannot be grown profitably for family use, and still there are thousands of farmers that do not grow them. This should not be the case, as they can be grown with so little trouble and expense. Strawberries ripen during the heat of early summer, when such an addition to the diet is most healthful and necessary.

Many have been deterred from planting the strawberry from the fact that their culture is not understood. It is a common opinion that a great deal of work is required to make them succeed. When grown in the old fashioned way of planting in beds in a garden or enclosure this is true. All the work has to be done by hand, mostly at a time when the farmer is so busy with the spring work on the farm he cannot attend to the strawberry patch. The location of a suitable place for the strawberry plantation often has much to do with the success or failure of it. Especially is this true with the farmer that has but little help, and can ill afford the time to give them proper care. This class of farmers are very numerous and it is the purport of this paper to make the method of culture so easy and simple that many who do not now grow the strawberry will be induced to grow at least enough for family use.

SOIL.

Any soil that will produce a crop of corn or potatoes will answer for strawberries. A rich clay loam is to be preferred, next, a sandy loam. Avoid if possible a stiff heavy clay as much more difficulty will be experienced in making a heavy tenacious soil. Also avoid any land that has been in sod or pasture a number of years. The *white grub* is the most destructive insect enemy we have to fight in growing the strawberry. It is usually found in the greatest numbers in the soil that has recently been two or more years in sod. A clover sod that has had but one crop taken off will answer. If the soil is not naturally rich it will pay to make it so with either barnyard manure or commercial fertilizers. It should be well drained either naturally or by tile draining.

LOCATION.

Select some convenient place where you will not have to go out of the way to cultivate. You can then go through them with horse and cultivator in a few minutes when you have been cultivating corn, potatoes or other vegetables and never miss the time; while if they were planted in some out of the way place they would often go without cultivation until the weeds got such a start that they could afterwards be cleaned out and cared for only with great difficulty. This is often the cause of failure. It is preferable to select a piece of land sufficiently large to admit of future plantings along one side.

PREPARATION OF THE SOIL.

If a clay or sandy loam or a one year old clover sod, it should be well ploughed in the autumn. If a light sandy loam, plough in early spring. After ploughing, top work the soil thoroughly in the spring as soon as the weather and the condition of the soil will permit. Cultivate deep with a two-horse cultivator and harrow down smooth. If the soil requires manure, apply well rotted barn-yard manure just before cultivating and harrowing. The manure should be well mixed with the top soil but not plowed under. A stiff, heavy loam may have an application of coarse barn-yard manure in the fall before plowing. If the soil is stiff or heavy, it should be trenched up in the autumn by turning two furrows together, forming a sharp ridge as when prepared for carrots or other roots. When thus exposed to the action of the frost a comparatively heavy soil will work down fine and mellow in the spring and give good results. Care must be taken, however, never to stir such soil when wet, either with plow, hoe or cultivator. Surface drains should be made to take off surplus water quickly.

PLANTING.

This should be done as early in the spring as the soil can be prepared as directed above. Mark off the rows with a corn marker about four feet apart. If a marker is not at hand stretch a cord to plant by. Take pains to have the rows straight and of equal distance apart. It adds to the appearance of the plot, and time is saved in the cultivation. Procure plants of the previous year's growth, trim off all old runners and dead leaves and shorten the roots to about four inches. Keep the plants moist and where the wind cannot reach them while out of the ground. This can easily be done by placing them in a pail or box and covering slightly with soil and taking them out only as fast as required for planting. When planting make a hole with a spade crosswise of the mark and deep enough to admit the roots without doubling them up. This is quickly done by shoving the spade straight down and pushing it backward two or three inches. Take the plant in the left hand, spread out the roots fan-shaped, place the crown on a level with the surrounding soil, fill in and work the soil well in among the roots and press so firmly that by giving a quick jerk on a leaf it will break off without moving the plant.

CULTIVATION.

As soon as the weed seeds start to grow and appear above ground, cultivation should begin. A fine-toothed cultivator is the best. Stir the soil frequently to a depth of about two inches, especially during the early part of the season. Care must be taken not to stir the soil immediately around the plant or injury will result. Cut off all the blossoms and first runners until the plants have sufficient strength to send out several strong runners at once, (which is usually in July) when these may be allowed to take root. The soil between the plants in the row that cannot be worked with the cultivator should be hoed out as soon as the weed seeds start to grow. At this time a steel garden rake will often do the work better and more quickly than a hoe. If the weeds are allowed to grow until they are two or three inches high before hoeing more than double the labor will be required, and the results will not be so good.

MULCHING.

As soon as the ground freezes in the autumn sufficiently hard to prevent horses and waggon from breaking through the crust, a mulch should be applied. This may consist of coarse manure, wheat or rye straw or marsh hay. Most of the material should be placed between the rows with just enough immediately over the plants to nearly cover them from sight. In early spring, as soon as growth begins, rake the mulch from off the plants and leave it between the rows. If the mulch is left on the plants for a time after they begin to grow, it causes a soft weakly growth of plant that will not produce fruit.

KEEPING UP THE PLANTATION.

This is often the most difficult problem to solve in strawberry culture on the farm. The usual practice has been to plant out a plot and give good care the first season ; result, a fine crop of fruit, with a promise that the strawberry patch shall be cleaned out and cultivated as soon as the fruit is off. This, however is rarely done ; after the fruit has been gathered we do not expect any more until next season. The ground gets too dry to cultivate and the haying and harvesting has to be attended to. The strawberry patch then gets a promise that it shall be cleaned out early the following spring. When spring comes the grass and weeds have such a strong hold among the plants that it is usually decided to let them go without any attention. With this treatment, at the end of the third season the plants will generally be so exhausted that but little fruit is produced and the young plants seldom possess that vigor required for starting another plantation successfully.

By adopting the following plan no difficulty will be experienced and a crop of strawberries can be grown as easily as a crop of potatoes, and with as little risk of failure.

Plant four or more rows one hundred feet or more long, *every spring* and grow as directed above. This will yield a sufficient supply for an average family, and if a selection is made of early and late varieties the season of ripening may be extended to four or five weeks. A new plantation can be put out every spring and cared for with much less time than would be required to clean out the old one. With this method a supply of strong healthy plants can always be had for replanting—a most important point in successful strawberry culture.

A plantation can be left to fruit the second season without any cultivation, you will obtain the earliest fruit from this old plot, and in a favorable season quite a large quantity of it. The greatest objection to allowing the plantation to remain for a second crop is, that it so often happens that a new plantation is not set out, if the old one is left for a second crop. The chances are therefore lessened for a future supply of both fruit and plants.

Selection of Varieties.

Every season some new sorts are introduced that, could we believe the disseminator's description, would excel all other kinds. But how seldom do we find one of these new highly lauded varieties that proves as valuable as some of the old, well tested kinds. Many of them have a local reputation and prove valuable with special care in localities suited to their wants. It is not possible to give a list of varieties that will do equally well in all localities. If you have a neighbor that succeeds with certain kinds on similar soil to your own, it is usually safer to plant the same sorts. This will generally give better results than to trust new varieties, no matter how much they have been lauded by the disseminator. Occasionally it is well to test new sorts in a small way, but this can mostly be left to those who can afford to experiment.

The following varieties have given satisfaction over a large area. For early, Beder Wood (B.) and Crescent Seedling (P.) For medium and late, Bubach (P.), Wilson (B.), Woolverton (B.), Saunders (B.), Lovett (B.), Williams (B.). Those marked (B.) are bi-sexual or perfect flowering varieties. Those with pistillate or imperfect blossoms are marked thus (P.), and require one row of the former with every three or four rows of the latter to fertilize them properly. The attention of farmers and amateur fruit growers is specially directed to this fact. Many of our most heavily producing strawberries (those marked P.) have only imperfect blossoms, and in order to produce fruit they must have planted along with them, or near by, other varieties (those marked B.), that have perfect blossoms, from which the wind and insects will then carry the pollen to the imperfect blossoms of the other plants.

Those named are vigorous growing varieties and should be planted about one and a half feet apart in the row, and rows four feet apart. They can be relied upon for either home use or market.

Bubach has given the largest yields on light or sandy soils, and the fruit is of the largest size. Beder Wood is perhaps the best, first early on light soil, and Crescent on stronger loam. Woolverton and Saunders succeed best on strong rich soil, and with good cultivation will give a crop of fruit that is difficult to equal either in size of fruit or quantity. The fruit is of a dark bright crimson color, of good quality and quite firm for so large a fruit.

Procuring Plants.

Procure plants from your own vicinity if you can get suitable varieties. If not, send to some reliable firm that charges enough for their plants to pay for good and careful packing, Poor plants are dear at any price and usually result in failure.

Growing for Local Market.

Many towns and villages throughout Ontario have to procure their supply of strawberries from a distance. Where such is the case it would pay some farmer in the vicinity to grow them for the local market. Begin in a small way and learn the methods best adapted to the conditions and wants of the locality. Strawberries fresh from the field will always bring a higher price than those which have been shipped in by train. There are few localities where strawberries cannot be grown in sufficient quantities to supply the demand, if proper methods of cultivation are followed.

PLUM CULTURE

By G. W. Cline, Winona, Ont.

Plum growing is a source of profit too often neglected by the farmers of this Province. With the exception of perhaps the apple, the plum can be grown more easily and cheaply than any other fruit. The advantages to the farmer in raising plums are two-fold: In the first place, his family can derive both pleasure and benefit from the use of the fruit while ripe and fresh in summer and fall, and also when canned or preserved it can be used in winter and spring. In any of these forms few fruits are more pleasant, palatable and wholesome than the plum. In the second place, the plum is one of the most profitable fruits for market, and this is no small consideration. For these reasons every farmer should have a plum orchard, small or large, as his experience may suggest.

Soil, Preparation and Planting.

Any good, dry soil will grow plums. If not dry, drain the land with tile or stone at least 2½ or 3 feet deep, or pine poles with a slab will do in case the other materials are not available. Plums will do well on all soils, from the lightest sands to the heaviest clays, by planting the proper varieties. A rather elevated situation is better than low land, as the trees in such a location are not so likely to be affected by late spring frosts. In preparing for planting, if the soil is a heavy clay sod, it is best to plow in narrow ridges in August and to harrow well in the spring. Then open out the ridge with the plow deep enough for setting out, plant in the bottom of the furrow and plow the soil back to the trees again; the rotting sod will help to keep the soil moist. For sandy or loamy soil, where the land will not bake by spring plowing, the best way is to plow and leave the furrow just where you want your row of trees, and plant as above. By this means you can plant a large number of trees in a day, and if the soil is properly pulverized and cultivated there should be no loss. If the season is inclined to drouth, mulch with coarse, strawy manure, but do not pour water down by the roots, as that washes the soil from the roots and causes more harm than good. Before planting the young trees it is well to make a thin mortar of fine earth and water and dip the roots into it, in order to keep them moist; do not keep the fibrous roots exposed to the sun or wind. In planting, lean all trees towards the prevailing winds, so that in growing they may stand up straight, and if they should be inclined to lean the wrong way bank up with earth and press them over. When loaded with fruit they are very hard to keep in upright shape, and if once allowed to be bent over with the yield they cannot be brought back to stay in an upright position.

As to the distance apart in planting, 12x16 is sufficient for most varieties, but for some of the larger and more spreading growers 14x16 is better. Among these latter varieties are Glass's Seedling, Quackenbos, Gen. Hand, German Prune, Yellow Egg and Victoria, and where you have land to spare, and it is rather rich, give them plenty of room, and you will not be sorry.

Cultivation of the Orchard.

Having set out your orchard, plant corn, roots or potatoes, and give plenty of cultivation, and if your trees were in good order when planted you will have success. Do not sow grain or turn to grass until the trees are at least three or four years old, when, if they are growing too large and are not blossoming, one season of grain or grass will cause the fruit buds to form; then turn to cultivation again, and you will not be likely to have any further trouble on account of the trees not fruiting.

Varieties.

Look about your own neighborhood and see what varieties are doing well, and in what kind of soil. Plant the best and most successful of these suitable to your own soil and conditions, and you will not be disappointed. Add a few other varieties for testing, but be careful in buying, remembering that the climate and soil vary so much in Ontario that no list of varieties would stand everywhere in the Province. If growing for profit, I would advise the planting of only a few varieties of tried reputation. Do not take the advice of any agent who comes along as to what sorts to set out, as such individuals are generally most anxious to sell what has been sent out with much puffing, one-quarter of which may not be true. Buying after this fashion is filling the Province with worthless varieties of fruit. Do not buy more than a tree or two of any new variety.

My list of plums for my own locality, as well as for all the southern part of the Province and some of the northern portion, in order of ripening, is as follows: Bradshaw or Niagara, Duanne's Purple, Imperial Gage, Washington, Smith's Orleans, Huling's Superb, McLaughlin, Lombard, Pond's Seedling, Glass's Seedling, Quackenbos, Yellow Egg, German Prune and Reine Claude de Bavery. The above are for clay or clay loam, and all are good growers and good bearers. For a sandy soil, which is not recommended as the best for plums, I would suggest: Duanne's Purple, Imperial Gage, Washington, Huling's Superb, McLaughlin, Lombard, Glass's Seedling, Reine Claude de Bavery and Coe's Golden Drop. In addition to the above are many more worth trying for those who care to experiment with varieties, such as Canada Blue, Peter's Yellow Gage, Genii, Jefferson, Fellemburg, Shipper's Pride, Shropshire Damson, Grand Duke, Saratoga, Field, Victoria, Gen. Hand, Prince of Wales, Red Egg, Lawson's Golden Gage, Prince's Yellow Gage, Bingham, St. Lawrence, Munroe Egg, Canada, Orleans, Prune de Agen and Abundance.

THE USE OF FERTILIZERS.

If the soil is not naturally rich it is of the greatest importance that some fertilizer should be applied. Barnyard manure, on account of the nitrogen it contains, is probably the best, but ashes and bone meal are generally required when the orchard is in full bearing condition, and these may each be applied at the rate of about 200 pounds an acre. Some soils, such as clays of a greasy nature, are full of potash, and consequently require only nitrogen and phosphate (or bone), and to use ashes on such land would be simply throwing them away. But in the case of sandy or loamy soils, where there is plenty of sorrel growing, the opposite is the case, and the ashes should be applied to sweeten it. Plum trees have been known to bear well under neglect, but that was where the new soil was rich and there was no black-knot or curculio to attack them. Now all this is changed, and if you want a long lived, profitable orchard, do not neglect to give the best of care in cultivation and fertilizing, or otherwise black-knot, bark sun-scald and death will finish them.

BLACK-KNOT.

I had so much black-knot a few years ago that I thought I was going to lose my orchard. However, I commenced cutting off the knot and burning it. Three times a year—in July, September and February or March—we went through the orchard, and also fertilized it well with nitrogen, phosphoric acid and potash. Trees revived where nearly dead, and at the present time I have but few cases of black-knot, and they are hard to find.

THE ROT.

The rot is a very serious disease, and it has been increasing for some years. I am now fighting it with Bordeaux mixture and sulphur, and I also pick off all rotten fruit, scalding them or burying them deep in the ground. I believe this is the best remedy, but I would like to have still another season's trial before finally deciding. My plan of operation has been as follows : Apply ammoniacal solution before the buds come out in leaf, then, after blossom, Bordeaux mixture two or three times, and throwing sulphur in the trees about the time of ripening. There are some who think plum rot is caused by a worm. To a certain extent this is true, as the plum is first stung by the curculio ; the spores of the fungus being at hand, the root attacks the spot, and by the time the rot has fully developed the worm has worked its way into the plum, and is taken as the cause of the rot. I would advise growers of plums to closely look after all rot, and pick every affected plum as fast as they can be found rotting, and in this way save the crop not only for that season, but make it better for the orchard in the succeeding year.

INSECT ENEMIES.

Of the insect enemies of the plum the curculio is the worst, and it appears to be always with us. My remedy is Paris green, 3 ounces to 40 gallons of water, sprayed on the trees just after the blossoms are all gone. Do not spray before that time, as it will then be of no use whatever. After the first application spray again at intervals of a week or ten days if no considerable amount of rain has fallen, but if heavy rain occurs spray oftener. I have sprayed as often as six times during the season with no harm resulting to the trees or foliage. When coming to the bottom of the barrel we have sometimes found that the solution was rather strong, and that some of the leaves have been scorched, but never sufficiently so as to damage the tree for future bearing. Be careful and weigh your Paris green. *Do not guess*, as some men, more especially employees, are inclined to do. Few men have an accurate idea of size or weight. In battling with the curculio Paris green has proved most effective with me, and far ahead of the old plan of jarring the tree. I have tried both methods, but for twelve years have not jarred, but used the arsenite. The canker-worm is another pest which is also killed by Paris green when spraying for the curculio, and many other injurious worms are also destroyed in the same way. The green aphis, however, is becoming very bad, as it is hard to get at, since its habit is to work on the under side of the leaf, which curls over and largely protects it. For this pest I use coal-oil emulsion, and whenever it touches them they are killed. I used only the horse-power sprayer on them last season, but will try the knapsack or a barrel on the stone-boat this summer so as to get close under the trees and thus get all of them covered.

MARKETING.

The marketing of plums demands considerable attention. I have always followed the rule to pick only the plums that are ripe; that is, all that are finely colored but not soft. Pack into 12-quart baskets (some prefer 8-quart baskets) and ship to orders, which should be arranged ahead as much as possible. We pick off the same trees for from three to six days, and never send any but the best to market. Many growers pick their plums a week ahead of ripening, and pick all at once, putting on the market what is nothing but a miserable apology for a plum, the fruit being really not fit to eat. It is a shame, and certainly a great mistake from a business point of view, to put plums on the market in so green a condition as to be unfit to be used. You cannot sell your plums well if you pick them too green. If you have secured no regular customers to take your plums, send the fruit on to a reliable commission man (and there are many of them), who can be depended upon to do the very best for an equally reliable customer.

FRUIT STATISTICS

The following table contains the numbers of apple, pear, peach, plum and cherry trees, and of grape vines in the townships of Ontario as computed for 1892 and 1893, from returns sent in by farmers and fruit-growers to the Department of Agriculture (Bureau of Industries.)

Districts.	1893.		1892.	
	Bearing Age.	Young Trees.	Bearing.	Non-Bearing.
APPLE TREES.	No.	No.	No.	No.
Lake Erie	1,296,335	409,771	1,264,495	459,296
Lake Huron	800,837	249,856	751,637	254,074
Georgian Bay	500,747	242,374	450,135	223,953
West Midland	1,164,110	292,200	1,097,843	308,063
Lake Ontario	1,993,891	447,905	1,961,607	460,617
St. Lawrence and Ottawa	786,100	316,937	750,621	309,334
East Midland	373,917	153,799	346,407	152,896
Northern Districts	17,426	31,839	15,235	32,711
The Province	6,933,363	2,144,681	6,637,980	2,200,944
PEAR TREES.				
Lake Erie	134,047	84,617	121,224	92,918
Lake Huron	46,975	27,246	45,216	28,137
Georgian Bay	22,486	33,253	17,474	32,556
West Midland	72,803	48,625	61,929	46,045
Lake Ontario	211,702	294,560	205,976	273,788
St. Lawrence and Ottawa	20,830	16,877	19,199	14,383
East Midland	12,071	9,834	14,045	10,992
Northern Districts	838	1,153	213	693
The Province	521,752	515,165	485,276	499,512
PLUM TREES.				
Lake Erie	56,230	82,400	48,533	79,291
Lake Huron	56,617	37,766	59,129	40,306
Georgian Bay	85,502	80,002	93,962	85,120
West Midland	68,337	75,957	62,943	74,317
Lake Ontario	247,960	333,427	225,181	332,743
St. Lawrence and Ottawa	127,226	40,589	130,732	38,970
East Midland	31,212	22,414	30,041	24,854
Northern Districts	9,477	7,539	8,933	7,814
The Province	682,561	680,094	659,454	683,415

FRUIT STATISTICS.—*Continued.*

Districts.	1893.		1892.	
	Bearing Age.	Young Trees.	Bearing.	Non-Bearing.
PEACH TREES.	No.	No.	No.	No.
Lake Erie	173,392	153,080	141,502	182,536
Lake Huron	10,516	7,055	9,118	8,275
Georgian Bay	1,688	3,013	1,859	1,322
West Midland	17,124	9,660	12,658	11,824
Lake Ontario	319,054	212,804	277,765	229,720
St. Lawrence and Ottawa	....	204	....	253
East Midland	99	498	198	617
Northern Districts	....	16	....	7
The Province	521,873	386,330	443,100	434,554
CHERRY TREES.				
Lake Erie	166,145	52,853	163,610	58,369
Lake Huron	82,713	27,535	81,138	29,420
Georgian Bay	53,293	28,769	54,796	23,314
West Midland	77,017	30,862	76,368	30,017
Lake Ontario	94,338	63,182	93,713	55,776
St. Lawrence and Ottawa	28,945	14,962	29,731	10,629
East Midland	13,954	10,046	12,348	10,684
Northern Districts	1,659	1,449	1,471	1,837
The Province	518,064	229,658	513,175	220,046
GRAPE VINES.				
Lake Erie	922,042	195,408	962,265	250,708
Lake Huron	37,506	34,335	35,715	24,762
Georgian Bay	23,194	8,774	28,455	8,052
West Midland	55,870	24,879	48,259	29,028
Lake Ontario	1,117,502	473,981	1,029,479	571,626
St. Lawrence and Ottawa	40,037	18,048	37,135	44,704
East Midland	26,013	26,864	31,911	20,605
Northern Districts	1,118	1,141	914	1,174
The Province	2,223,282	783,430	2,174,133	950,659

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ONTARIO AGRICULTURAL COLLEGE,

DAIRY DEPARTMENT.

BULLETIN XCIII.

DAIRY BULLETIN,

BY THE

SPECIAL DAIRY SCHOOL.

MILK TESTING.
SEPARATOR CREAMERIES.
CREAM-GATHERING CREAMERIES.
SPRING CHEESE.
SUMMER CHEESE.
FALL CHEESE.

PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE.

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BULLETIN XCIII.

DAIRY BULLETIN.

This Bulletin has been prepared by Committees of the Special Dairy School, 1894, at the Ontario Agricultural College. The portion relating to cheese is largely a reprint of Bulletin LXXXVIII. The committees are :

MILK-TESTING.—L. A. ZUFELT, Chesterville, Ont., Instructor in Milk-Testing ; T. B. MILLAR, London, Ont., Assistant Instructor in Cheese-Making ; WM. CAMPBELL, Cannamore, Ont.; MISS G. E. PEACOCK, Mt. Salem, Ont.

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SUMMER CHEESE.—T. B. MILLAR, London, Ont.; JAMES POOLE, Waba, Ont.; E. A. BELL, Crown Hill, Ont.

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MILK-TESTING.

The term, milk-testing, up to a few years ago, simply meant the detection of adulterations in milk. Now, however, it means a little more, viz., the comparative valuing of the different milks delivered, either to a cheese factory or creamery. We may, therefore, divide the work into two parts—first, the detection of adulterations in milk and second, paying for milk according to quality or, as it is commonly called, the test plan.

DETECTION OF ADULTERATIONS IN MILK.

The most usual adulterations of milk are the addition of water and removal of cream. Those factory men who pay for milk according to quality need have no fear of either of these, as the system makes it the interest of every man to supply as rich milk as possible, but as there are many factories that still do business on the pooling system, it is thought advisable to describe the methods by which said frauds may be detected.

The first step to be taken is to find out the specific gravity of the milk. This is done by means of the Quevenne lactometer, which has a scale corresponding to the Sp. G. (specific gravity) of milk. The graduated scale from 15 to 40 being equivalent to a Sp. G. of 1.015

to 1.040; thus a milk which has a Sp. G. of 1.032 would show on the lactometer a reading of 32. These lactometers are made to give the Sp. G. at a temperature of 60° F., and as it is not always convenient to have the temperature of the milk at 60° when the reading is taken, corrections may be made for slight variations (not more than 10°) by adding to the L. (lactometer) reading .1 ($\frac{1}{10}$) for each degree of temperature above 60°, or subtracting .1 for each degree below 60°. For example, the L. reading is 29, and the temperature 68°; then the correct reading or Sp. G. for 60° would be $29 + .8 = 29.8$. Had the temperature been 56°, the correct reading would be $29 - .4 = 28.6$.

The average composition of milk is as follows:

Water, 87 to 88 per cent.

Fat (F.), 3.0 per cent. and upwards.

Solids not fat (S. N. F.), 8.5 to 9.5 per cent.

The Sp. G. or L. reading of pure milk ranges from 28 to 34, skim-milk 33 to 36.

The next step to be taken is to find out the per cent. of fat. This we do by means of the Babcock Tester. Then having obtained the per cent. of fat and the Sp. G., the per cent. of S. N. F. (solids not fat) may be obtained by the following formula:

$$\frac{\text{L} \times \text{F.}}{4} = \text{per cent. of solids not fat.}$$

L=Lactometer reading or specific gravity at 60°.

F=Per cent. of fat.

To find the extent to which a known sample of milk has been watered, multiply the per cent. S. N. F. in the adulterated sample by 100 and divide by the per cent. S. N. F. in the pure sample. The result will be the number of pounds of pure milk in 100 pounds of the sample examined, and the remainder will be the number of pounds of water. Pure milk contains not less than 8.5 per cent S. N. F., and often as high as 9 and 9½ per cent., and where it is not possible to get a sample of the pure milk for testing, use 8.5 as a standard for the first half of the season and gradually increase to 9 as the season advances, say beginning to use 9 the 1st of September. To make the foregoing more plain, take the following example:

L. reading 28, temp. 54°, per cent. fat 2.6, and, suppose the pure milk to test 9 per cent. S. N. F. Required to find the per cent. of water added. The correct L. reading is $28 - .6 = 27.4$, then substituting for formula we get:

$$\frac{27.4 + 2.6}{4} = \frac{30.0}{4} = 7.5 \text{ per cent. S. N. F.}$$

$$\text{then } \frac{7.5 \times 100}{9 \text{ (per cent. S.N.F. in pure milk)}} = \frac{750}{9} = \left.\begin{matrix}83.\dot{3} \text{ per cent.} \\ \text{pure milk.}\end{matrix}\right\}$$

Then $100 - 83.\dot{3} = 16.\dot{6}$ per cent water in the adulterated sample.

Points to be Observed.

1. Always mix milk well before taking the lact. reading. Do this in such a manner as not to make it froth or foam.
2. If it is desired to change the temperature of the milk, do so in such a way that it will be uniform throughout.
3. Always let milk stand an hour after being drawn from the cow before testing with the lactometer, as it is saturated with air and has not reached its maximum density.
4. When the L. reading is high (33 and upwards) and the per cent. of fat low (below 3 per cent.) it is an indication of skimming.
5. When the L. reading is low (below 28) and the per cent. of fat low, it indicates watering.
6. When the L. reading is normal and the per cent. of fat *very* low, it indicates both skimming and watering.

NOTES ON HANDLING THE BABCOCK TESTER.

1. See that bottles are properly graduated. This may be done by filling up to the O mark with water of the same temperature as the room, after which carefully wipe out the neck with filter paper. Then put in 2 c.c. of water with a 2 c.c. pipette, which should fill the neck up to the 10 per cent. mark. If the variation is more than .2 per cent. the bottle is not correct and should be discarded. Another very good way and perhaps the most practical, is to test one quality of milk with all the bottles and compare the readings, keeping only those bottles which give the same results.
2. Have bottles numbered.
3. Determine strength of acid. This may be done by using different quantities and thus find out which gives the best result.
4. Be sure and get a representative sample of milk in the bottle, by thoroughly mixing before measuring with the pipette.
5. Be sure and get the correct amount (17.6 c.c.) in the bottle by blowing all the milk out of the pipette into the bottle.
6. Pour in the acid so that it will run down the side of the bottle under the milk, and not directly through it, otherwise you will be likely to have charred portions of casein and milk-sugar mixed with the fat.
7. Thoroughly mix acid and milk by giving the bottles a rotary motion, seeing that no portion of the milk enters the neck of the bottle.
8. Place immediately in the machine and revolve for four minutes at the rate of from seven to twelve hundred revolutions per minute, according to the size of the machine.
9. Then add water at a temperature of not less than 130°, being careful not to fill above the 10 per cent. mark.

10. Revolve again for one or two minutes.

11. Place bottles at once in a hot water bath, after which read carefully from highest to lowest limits of fat, holding the bottle in a perpendicular position and the fat on a level with the eye.

12. Empty bottles directly after reading and rinse out twice thoroughly with hot water, using when necessary a little sal soda in the first water.

13. Always keep bottles *clean.*

14. The warmer the milk the less acid is required, and *vice versa ;* consequently in the fall of the year it is advisable to warm the milk to about 70° by placing test bottles in a pan of hot water, or else use more acid.

15. Always keep bottles warm.

16. Dark, cloudy readings are caused either by using too much acid, milk at too high a temperature or acid not being properly added. If butter-fat is of a light color with particles of a curdy matter mixed with it, it indicates either not enough acid has been used, or milk has been too cold, or milk and acid have not been thoroughly mixed.

17. Be careful and exact from beginning to end if you wish to be successful.

PAYING FOR MILK ACCORDING TO QUALITY.

This system assumes that the relative values of all milks that are pooled together for either butter or cheese, are in direct proportion to the amount of fat which each contains. The method is applied by dividing the net proceeds among the patrons in proportion to the total amount of fat which the milk supplied by each contains. To illustrate take the following example :—A., B., C., D., represent the patrons of a factory. The amount of milk which each supplied and also the quality being as follows :

A.	1,000	lb.	testing................	3.7	per cent. fat.
B,	2,000	“	“	3.5	“
C.	3,000	“	“	3.8	“
D.	4,000	“	“	4.0	“

From this milk was manufactured 1,000 lb. cheese which sold for 10c. per lb. and the cost of manufacturing being $1\frac{1}{2}$ c. lb. Required to find the amount of money each should receive, the butter-fat as explained below, being worth 22.31c. per lb.

The total lb. of fat in each patron's milk is found by multiplying the number of lb. of milk by the per cent of fat and dividing by 100, as per cent. simply means, so much in 100. The total amount of cheese made was 1,000 lb. which sold for 10c. and cost of manufacture was $1\frac{1}{2}$c. this would leave $1000x(10-1\frac{1}{2})$ or $1000x8\frac{1}{2}=$ \$85.00 to be divided. Now divide this amount by the total number of pounds of fat, which is 381, and we will get the price for one pound which is $\frac{85.00}{381}=22.31$ cts. Then by multiplying the number of lb. of fat which each patron supplied by 22.31 cts. we will get the amount of money which each should receive.

Name of Patron.	Lb. of Milk.	Per cent fat.	Total lb. fat.	Price per lb.	Amount which each should receive.
				cts.	\$ c.
A.	1,000	3.7	37.	22.31	8 25
B	2,000	3.5	70.	22.31	15 62
C	3,000	3.8	114.	22.31	25 43
D.	4,000	4.0	160.	22.31	35 70
Total.	. . . .	. . . . . .	381.	. . . .	85 00

Again, supposing the milk had been made into butter and the yield was 425 lb., which sold for 24c. and cost of manufacturing was 4c.lb. we would then have 425x20c.=\$85.00 to be divided among the patrons or the price per lb. of fat would be 22.31 cts. the same as in the previous example, and the amount which each would receive would be the same as before.

THE COMPOSITE TEST.

As it is impossible in large factories to make a test of each patron's milk every day without a great deal of extra expense and labor the best method to pursue is that of composite sampling. This is done by taking a sample of each patron's milk each morning, say 1 ounce, and put in a glass jar or sealer along with about 5 or 10 grains (or about what will lie on a 10-cent piece), of bichromate of potash. This quantity is sufficient to keep the milk in a perfectly liquid condition for one or two weeks, at the end of which time the test can be made in the usual way, care being taken however, to have the cream and milk thoroughly mixed before taking the sample with the pipette. The result will be the average per cent. of fat in all the milk supplied by each patron up to the time of making the test. Then to find the amount of fat which each delivered, multiply the total amount of milk sent, by the per cent. of fat and proceed as in the example given above.

In this way tests can be made once every one, two, three or four weeks with equally good results, as samples have been kept for two months and longer which tested as well as when kept only one week, but where convenient, testing every two weeks would perhaps give better satisfaction to the patrons.

Observe Carefully the Following Points.

1. Get a fair representative sample of milk each morning.
2. Shake the sealer or jar with a rotary motion each time a new sample is put in, being careful not to churn the milk.
3. If samples are kept for three or four weeks, use a corresponding larger quantity of the bichromate.
4. If cream should gather on the samples and become thick so as not to readily mix with the milk, before testing, stand the jars in warm water for a few minutes, shaking frequently when the cream will quickly dissolve again.

THE SEPARATOR CREAMERY.

In the creamery, as in the private dairy, the first and most important requisite to success is cleanliness.

As it is impossible to turn out a good finished article without good material to work upon, no milk should be accepted but that of good quality and free from any objectionable odor or taint. It is important that milk should be ærated as soon as drawn from the cow, care being taken to see that the air is pure. It should also be protected from rain ; rainwater in milk makes it impossible to secure a good quality of butter. Milk from healthy cows only, fed on wholesome food and having access to pure water, should be accepted by the buttermaker. The pastures, yards and lanes should at all times be kept free from carrion and all decaying matter.

The milking should always be done with dry hands and in a cleanly manner, the udder being well brushed or wiped with a damp cloth. All vessels, pails, etc., should be of tin, and should be thoroughly scalded each day. Wooden pails should never be used. The buttermaker should at once reject any milk that is found to contain any bad odor, or any that is delivered in cans not properly cleaned and scalded. It is well to accompany the rejected milk with a notice as to its defect, and also, if possible, with the remedy.

After strictly enforcing the foregoing, the butter-maker should keep the factory in the best possible condition, as an example to those of his patrons who may visit him.

In order to keep the separator in good running condition, all oil must be kept wiped off, and the bearings kept free from any water, dirt or grit. Keep all parts with which the milk comes in contact thoroughly clean and well scalded every day.

The temperature of the milk to be separated should be from 80 ° to 85 °, not allowing it to go higher, as the cost in time and ice in cooling is increased, and the quality of the product is likely to be injured.

The cream should be cooled as soon as possible after separation to about 45 ° to 50 °, and held at that temperature until about eighteen hours before churning, then warmed to about 60 °, or churning temperature. If the cream should not ripen sufficiently, add sufficient starter to give the cream a sharp, acid taste and glassy appearance on the surface. About two per cent. of starter will usually be sufficient.

To prepare the starter, take fresh skim milk that is known to be free from any odor or taint and warm it to 90 °, keeping it at that temperature for twenty-four hours, when it will be ready for use. It should be kept excluded from the air as much as possible, more especially if the air be at all impure. Use a small amount—about one per cent.—of the starter already made to stimulate the development of the next day's starter. This may be omitted on Saturdays, as the length of time over Sunday will give sufficient development of lactic acid, and the starter will be entirely fresh each week.

We favor cooling the cream to a low temperature immediately after separation, and ripening it in a few hours, using starter when the season and condition of the milk requires it, for the following reasons:

1. The solids in cream other than fat are subject to rapid decomposition.
2. This decomposition is not favorable to the keeping quality of whatever it effects.
3. Butter always contains a proportion of solid matter that is not fat, and the less this has advanced towards decomposition the better the flavor of the butter, and the longer will this flavor be retained.
4. This decomposition in cream is very rapid at a high temperature, while at a low temperature it is retarded.

Churning.

See that the churn is well cleaned inside, with a brush, at least once a week in cold and twice a week in hot weather, and scalded each day before and after using. Cool it before putting in the cream, which should always be strained into the churn.

Thick cream churns easier than that which is thinner; but to get the best results it should contain from 25 to 30 per cent. butter-fat.

If for any reason it should be thicker than this, it should be diluted with pure water or skim milk of the proper temperature. Churn at as low a temperature as is possible to get butter in from thirty-five to seventy minutes. To warm or cool cream, do so by putting warm or cold water or ice around the vat or vessel containing it, and stir it frequently. Never put hot water, steam or ice directly into the cream, as this tends to injure the grain of the butter, and causes in two many instances white streaks and poor flavor.

When necessary to use color, add sufficient to make the butter as nearly as possible the color of that made in June. Always add the color before starting the churn. About one-half ounce per thousand pounds of milk in winter will usually be found sufficient, gradually increasing to that amount in the fall, and lessening towards spring.

As soon as the cream breaks, or at the first signs of butter, add enough cold water to lower the contents of the churn 2° or 3°, and continue to churn until the butter granules are the size of wheat grains. Allow the churn to rest in a position to draw off the buttermilk for four or five minntes, that the particles may all rise to the top. Then draw off the buttermilk, straining it to prevent any loss of butter. Add at least as much water as there was buttermilk at a temperature of 50° or 52° in winter, and 45°, as nearly as possible, in summer. Revolve the churn as fast as possible for about two minutes, then draw off the water, straining as in the case of the buttermilk. Then add the second water—about the same quantity as for the first water—at 56° to 58° in winter and 52° to 58° in summer, and repeat as before. If for any reason the second water does not come off clear, or nearly so, repeat the washing until it does.

Allow the contents of the churn to drain well; then take the butter out carefully, using a wooden spade, care being taken to keep it in a granular form. Weigh, and place the butter on the worker, adding salt sufficient to suit the taste of the customer. From three-fourths to one ounce of salt to one pound of butter will usually be found sufficient.

Work carefully and evenly, avoiding any rubbing or friction, until the salt is evenly distributed and excessive moisture is expelled. From seven to eight times over will usually be sufficient. Turning inwards and outwards, then doubling, is meant to be once over on the power worker. Then pack in tub. If for prints, about five or six times over will be sufficient working.

To prepare ash or spruce tubs for use, they should be pickled in hot brine for twenty-four hours or steamed over a steam jet for thirty minutes. Tin-lined tubs should be thoroughly scalded and cooled before using. Remove any resin or specks on the tin. Put the butter in the tub in small quantities, pounding it thoroughly around the edges with a suitable pounder, keeping the surface of the butter level. The tubs should be filled to within one-half an inch from the top, leaving the surface slightly crowning. Cover with parchment paper or butter cloth, or, what is better, with both. This should be covered with a salt paste, made by putting salt in cold water. The tubs should be filled until the salt is level with the top of the tub. Lining the tub with parchment paper before putting in the butter will be found to give good results.

The temperature of the storage room should not be higher than 56 °, and as much lower as it can be kept uniform.

THE CREAM GATHERING CREAMERIES.

In order to attain a good reputation for our butter made in cream gathering creameries, the patrons who supply the cream should take a lively interest in supplying it sweet, clean and of pure flavor. To do this cleanliness must be the watchword. All pails and other utensils should be thoroughly washed and then scalded, after which they should be placed outside in a pure atmosphere to become well aired. Never use a cloth for drying any of the tinware after scalding them.

The milk room should be kept cool, clean and with no bad odors.

Strain and set the milk immediately after milking, in water at a temperature of not more than 45 degrees in the summer and 38 to 40 degrees in the fall and winter for at least 12 hours in summer and 24 hours in winter. Every farmer who handles milk should use a thermometer, so that he may know that the milk has been cooled to the temperatures named above, as the loss of cream or butter-fat is very great when the milk has been cooled to but 50 degrees. To have profitable returns from the handling of milk for a creamery, the patrons should provide plenty of ice and have it stored in a convenient place near the milk room. The water in the tank should be changed frequently, and care should be taken to prevent any milk getting with it and allowing it to become tainted from this or any other cause. If care and good judgment is exercised much unnecessary trouble and labor can be avoided. It is not necessary to change the water more than once every second day where good clean ice is used. Where the skim milk is not drawn off from the can at the bottom a skimmer made 4½ inches in diameter at the top, without any wire around the edge and tapering to a point 7 inches deep, with a handle 10 to 12 inches long, will be found very convenient for skimming the cream from the top of the can. If the skim milk is drawn from the bottom of the can, a strip of glass should be soldered from the bottom upwards, so that the cream can be seen when it reaches the bottom. Tip the can a little so as to allow all the skim milk to run out without taking any of the cream. We would suggest having a bottom with three inches slant to carry off all sediment that may be at the bottom along with the first skim milk. But for general use we would recommend skimming from the top, as there will be less sediment in the cream. Where the cream has been forced up in 12 hours there will be more inches of cream than if the same milk was allowed to set for 24 hours, but the yield of butter will be about the same per hundred pounds of milk. Where the temperature of the milk cannot be lowered to 45 degrees we would recommend setting the milk for 24 hours. The per cent. of butter-fat in the cream depends on the amount of skim milk in the cream. The depth or inches of cream on the top of the can depends on the per cent. of fat in the milk and the temperature to which the milk has been cooled. There will be more cream on milk containing 4 per cent. butter-fat than on milk containing 3 per cent. There will be more on milk cooled to 42 degrees than on the same milk cooled to 50 degrees.

As an educator for dairy farmers we know of nothing equal to the Babcock milk tester, which is simple and easy to operate, and would strongly recommend all dairy farmers to have, in some way, their individual cow's milk tested (also the skim milk) as we know there are a large number of unprofitable cows fed and kept which should be disposed of. Each cow should give at least 6,000 lb. milk, which should make about 250 lb. butter per year. The skim milk should be tested that the farmer may know whether he is getting all the cream out of the milk. We have frequently tested skim milk from farmers, showing from 1 to over 1½ per cent. of butter-fat, which means a loss of about 25 per cent. of all the butter-fat in the milk, or in other words a loss of from 20 to 25 cents per hundred pounds of milk. No expensive creamer is necessary to get all the cream out of the milk, so long as you can maintain the proper temperature, as it is the temperature of the water about the milk which does the work and not the creamer into which the cans or pails of milk are placed. Any ordinary box or barrel which is clean and will hold water, will do the work as efficiently as the most expensive creamer made.

Where shallow pan cream is taken to a creamery the milk should be set in a clean cool room at a temperature of 60 degrees and lower, for 24 hours, but no longer, as all the cream will be up in that time and of a better quality than if allowed to remain longer, as the cream being exposed to the air in warm weather becomes thick and tough and will not run through the strainer at the creamery, which means a loss to the other patrons who supply good cream. Such cream should be rejected, as it is better to lose one patron than ruin the reputation of the creamery, as it is difficult to make good flavored butter from shallow pan cream because there are very few milk rooms throughout the country which are fit to set milk in. Good flavor is the most important point about butter. Buyers look for flavor first. If the flavor is bad, down goes the price. We would recommend for creameries that all milk should be submerged in the water to protect it from any foul odors that may be about the dairy.

(Some of our best creameries refuse to take shallow pan cream at all. This, no doubt, is the safest plan.)

Where cold water or ice cannot be got we would recommend for a herd of from 15 to 20 cows a cream separator. These separators usually leave about one-tenth of one per cent. of butter-fat in the skim milk, while milk from the deep setting when cooled to only 50 degrees usually has about one per cent. But if the same milk had been cooled to 42 degrees or 45 degrees the loss of fat would be but from one to three-tenths of one per cent.

CARE OF CREAM

After the milk has been carefully skimmed the cream should be submerged in water in a can specially made for the purpose, keeping the temperature somewhat below 50 degrees, stirring well each time fresh cream is added. If the cream is cared for in this way there will be no complaints about sour cream and the patron will have done his duty in supplying the butter-maker with the raw material in prime condition to make gilt edge butter. Cream should not be set in open crocks or pails in cellars, pantries or any other place where the air is not perfectly pure, nor where the temperature is above 60 degrees, as it is sure to sour and may be in churning condition before taken to the creamery. When the cream vessel is emptied, it should be well washed and scalded, and placed where it will get plenty of fresh air. All cream vessels should have an airtight cover, and we would recommend having the seams in all milk vessels well filled with solder, which if not filled, an accumulation of dirt having a yellow color which will taint the milk, will be seen.

THE CREAM GATHERER.

He should be clean, courteous, obliging and honest. He should keep the cream cans or tank thoroughly clean and in the best possible condition for the reception of the cream and should allow the cans or tank to get all the fresh air at night possible. The wagon should be kept clean. The managers of the creamery should see that this as well as many other things of like importance are attended to.

The collector should be very careful about the measurement and mixing of the cream before the samples are taken, as carelessness on his part may cause a shortage of butter and an unjust division of the proceeds. The cream should be stirred earefully after it is poured into the measuring pail so as to make it uniform before the sample is taken for testing. Measure carefully and give the patron credit for the full number of inches. Give a statement of all cream received from each patron and the date to the person in charge of the creamery.

The manager of the creamery should take steps to have the cream delivered at a temperature not above 60°. To do this tanks or cans should be provided with dead air spaces around the cream so as to protect it from the heat, and the wagon should be covered to protect the tank or cans from the sun. If the patrons will do as directed in the care of the cream it can be delivered much cooler than is usually done, and a superior quality of butter can be made. The cream should be strained through a perforated tin bottom strainer into the vat, also from the vat into the churn. After the cream is in the vat, take the temperature and also ascertain if it is turning sour. If the cream is sour cool at once to 56° or 58°. Sweet cream should be set at 60° to 61° over night in warm weather and from 62° to 63° in cold weather. As a rule cream is delivered through the summer at too high a temperature, and generally it is soured more or less, and it is always safe to cool down to about 56° within an hour after it is delivered into the vat and held at that temperature over night. These temperatures are given only as a guide, and the butter-maker should bear in mind that the lower the temperature the cream is ripened at, so long as the desired amount of acidity is attained, the firmer will be the texture of the butter, if the churning temperature is right. Ripening cream and churning cream at a high temperature should be avoided, as the butter will have a soft texture or body. A good supply of ice should be stored for use in warm weather to cool the cream by breaking it up fine and putting in the water around the vat. Never put ice directly into the cream in the vat or churn.

(For churning see "Separator" portion of Bulletin.)

OIL TEST CHURN.

1. See that representative samples are taken and that test tubes are not over half full.
2. Place in water at a temperature of 70° over night to ensure a perfect ripening of the cream.
3. Churn at a temperature of from 75° to 80°.
4. After a thorough separation of the butter place in water at a temperature of not less than 170° for at least 20 minutes.
5. Cool again to 70° or 75°, churn and reheat after which the readings may be taken. Readings should be made carefully and the test recorded for each patron.
6. If the separation of butter oil is not perfect, cool, churn and reheat again.

SPRING CHEESE.

The cheese-maker who is desirous that his cheese shall be of the finest quality will accept nothing but good, pure milk. All tainted or sour milk and the first milkings (colostrum) should be refused.

Heat the milk to 86° Fahr. The rennet test should then be used to ascertain the degree of ripeness. To make this test take 8 oz. of milk from the vat, add to it one drachm of rennet, stir rapidly ten seconds and if coagulation takes place in from 17 to 20 seconds the milk is sufficiently matured for the addition of the rennet. A slight variation from this may be necessary to suit different localities, but a few trials will enable the maker to tell when the milk is properly ripened. A very simple way to tell the exact moment when coagulation takes place is to drop a bit of burnt match into the milk. It assumes a rotary motion when the milk is stirred. Then count the number of seconds from the addition of the rennet until the stick ceases to move. This gives you the exact time required for the milk to coagulate.

Ripen the milk to that condition that all the whey may be run off in 2½ hours after setting, and the curd showing ⅛ inch acid after dipping. Great care and watchfulness should be exercised at this season as acid develops very rapdily during the early period of lactation.

Use sufficient rennet (from 3 to 5 oz. per 1,000 lb.) to coagulate the milk fit for cutting in from 15 to 20 minutes. In cutting use the horizontal knife first and begin when the curd is somewhat tender. Cut slowly, with a firm, steady motion and continuously, until the cutting is completed.

Let the curd settle a few minutes to allow the surfaces to hea slightly, then stir with the hands—very gently and slowly at first—for about ten minutes. Rough handling at this period sets free a great number of small particles of curd, which go off in the whey and very materially lessen the yield. Then the agitators may be put in and the steam gradually turned on. Take about 30 or 35 minutes in heating up to 98°. Continue stirring about ten minutes after the steam has been turned off, when the curd may be allowed to settle. Draw off a portion of the whey at this time that you may not be caught by a rapid development of acid. Then stir the curd occasionally (a common hay rake is best suited for the purpose) to prevent matting and to secure a thorough cooking of each particle of curd.

When the curd is thoroughly cooked and shows about ⅛ inch of acid on the hot iron, the whey should be removed. After dipping, the curd should be well stirred with the hands to effectually drain off the whey before allowing to mat. When it has become sufficiently matted, cut into convenient strips (about 8 inches wide) and turn. In about ten minutes they may be turned again and piled two deep. Turn frequently (four or five times an hour) to prevent any whey collecting on or about the curd and to ensure uniform ripening. The temperature should be maintained at about 94° while the breaking-down process is going on, and when the curd presents a flaky appearance on being pulled apart and shows acid to about ¾ inches, it may be milled and then aired by stirring occasionally. When it becomes soft and velvety, smells like newly-made butter and shows some fat on being pressed in the hand, it may be salted at the rate of from 1½ to 2 lb. of salt per 1,000 lb. milk.

The temperature when salting should not be higher than 86°. Put to press in about fifteen or twenty minutes, or when the salt is thoroughly dissolved. Have the temperature at this time between 80° and 85°.

Apply pressure gently at first, until the whey begins to run clear, then gradually increase. After the cheese have been in press about 45 minutes, they may be taken out and neatly bandaged; only pure water should be used. They should be turned again in the morning. See that no rims or shoulders are left on the cheese, but have them neat and stylish in appearance and of uniform size. They should be pressed for at least 20 hours before being removed to the curing room.

The curing room should be kept at an even temperature of about 65° or 70°, and should be well ventilated.

SUMMER CHEESE.

The same treatment is required in handling and caring for the milk as for spring cheese. Aeration and cleanliness should have the same careful attention. When the milk arrives at the factory each can should be subjected to strict examination by the cheese-maker (don't leave this to the poorest helper) to detect, if possible, and reject all bad flavored or tainted milk. There is no excuse for having milk of this kind. What one patron can do all can do—care for it properly and have it arrive at the factory in the very best possible condition.

When the milk has been received, heat up gradually to 86°. When this has been done, try it with the rennet test to ascertain the degree of ripeness. It is advisable to do this even in handling very ripe milk, for it enables the cheese-maker to know just about how fast the curd is going to work. If possible, have the milk in that condition that all the whey will be drawn in from 2½ to 3 hours from the time the rennet is added, with ¼ inch acid on the curd by the hot iron test. Use enough rennet to coagulate the milk sufficiently for cutting in 30 minutes. Start to cut a little early. Take plenty of time and don't hash or slash the curd. Use the horizontal knife first, finishing with the perpendicular. When the cutting is finished, start to stir very gently at first or until the curd is somewhat firm. Do not apply heat for ten or fifteen minutes after stirring has commenced. Heat gradually up to 96° or 98°, taking fully one-half hour to do so. Continue stirring for some time after the desired temperature has been reached to prevent matting and to ensure a more uniform cooking of the curd.

Draw off part of the whey soon after the heating has been finished, and if there are any bad odors or taints, draw the whey down quite close to the curd. By keeping it stirred and well aired, the flavor will be very much improved. Draw off all the whey when the curd shows $\frac{1}{4}$ inch acid by the hot iron test, and continue hand stirring until it is sufficiently dry before allowing it to mat, and, when matted, break or cut into convenient strips and turn it over at short intervals (about every fifteen minutes), piling a little deeper each time it is turned and never allow any whey to gather on or around it.

Grind early, or when the curd strings 1 to $1\frac{1}{4}$ in. on the hot iron. Keep it apart and well stirred and aired after grinding until ready for salting.

In handling over ripe milk, set at a lower temperature; use more rennet, cut finer, cook quickly, draw off part of the whey as soon as possible, dip curd with less acid, stir well before allowing to mat, grind early and mature well before salting.

In the case of gassy curd, try to retain more moisture in it when the whey is drawn off, by stirring less. Grind in about the usual time, and when it is partly ripe pile deep, and if the whey begins to lodge around it open the pile to allow the whey to drain off, then pile again. Continue in this way until the curd becomes velvety and buttery, when it is ready for salting. Use at the rate of $2\frac{1}{2}$ to $2\frac{3}{4}$ lb. of salt per 1,000 lb. milk. Hoop in from 15 to 20 minutes after the salt has been well stirred in.

Apply pressure very gently at first. After the whey begins to run clear, it may be safely increased. In from 45 to 60 minutes the pressure may be removed, the hoops taken off, the cheese dressed neatly, and put back to press again. Apply full pressure before leaving them for the night.

Turn in the hoops in the morning, pare off any corners or shoulders which may arise from imperfect fitting followers, putting back to press for five or six hours longer, when the cheese will be ready to take to the curing room, which should be kept as cool as possible during the summer.

We would strongly advise cheese-makers to keep a record of each vat, the condition of the milk, and how it works each day. Stencil each cheese with the date when made, the number of the vat it was made in, and by so doing a great many difficulties may be overcome.

FALL CHEESE.

Milk in the fall is usually sweeter and in better condition than in summer, so that the heat may be applied sooner or when it is being received into the vat; care being taken to have it stirred carefully all the while the steam is going on. Heat to 86° then apply the rennet test to ascertain the condition of milk, and if found too sweet for the application of rennet, use some clean flavored starter. Set vats at that stage of ripeness which will insure thorough cooking of the curd before the removal of the whey, which takes ordinarily three hours from the time the rennet is added until it is all removed and curd showing $\frac{1}{4}$ inch acid. Enough rennet should be used to cause perfect coagulation in from 40 to 45 minutes.

When ready for cutting, start by using the horizontal knife first and cut continuously until completed.

After the cutting is completed the curd should be stirred very carefully for 10 or 15 minutes before any heat is applied, then raise the temperature gradually to 98°, taking about 45 minutes to do so.

Stir the curd carefully all the while steam is going on and for some time after the desired temperature has been reached to prevent matting and to insure a more uniform and thorough cooking.

Remove the whey when the curd shows $\frac{1}{4}$ inch acid. Drain well by hand, stirring before allowing to mat and when matted sufficiently cut or break into convenient strips, and turn them over occasionally, reversing the position of the curd each time. Piling may be allowed at this stage two or three deep, but never allow any whey to gather in pools on or around the curd. If this is noticed at any time, the curd should be opened out at once and whey allowed to escape. Keep up the temperature to not less than 94° until grinding. When curd feels mellow and will pull apart in flakes or show $1\frac{1}{4}$ to $1\frac{1}{2}$ inches of acid, it should be put through the curd mill. Stir and air well immediately after milling and at intervals to keep it from matting until ready for the salt.

When the curd is well matured and has a velvety feel and a buttery appearance, the salt may be applied. Use at the rate of $2\frac{3}{4}$ to $3\frac{1}{4}$ lb. per 1000 lb. milk, varying the quantity to the amount of moisture in the curd. The temperature at this stage should be about 86°. The curd may be hooped and put to press in from 15 to 20 minutes after the salting is done. Apply the pressure very slowly at first, or until the whey begins to run somewhat clear, when all the pressure can be safely applied.

Allow the cheese to remain in the press not less than 45 minutes before taking out to dress.

See that the dressing is done neatly. Do not allow any wrinkles to remain in the bandage, but have it drawn up smoothly and laid over each end about $\frac{3}{4}$ in. Use clean, sweet cap-cloths, one on each end of the cheese, and have them laid on smoothly. Only pure, warm water should be used in bandaging.

Turn the cheese in the hoops every morning and never allow a cheese to be placed in the curing room without a perfect finish. The temperature of the curing room should be maintained as near as possible to from 60° to 65°. Cheese when taken to the curing room should be placed on the top shelves and removed to the lower ones when room is required, as by doing so there will be more uniformity in curing.

When coloring pour the coloring into a dipper of warm milk from the vat, then draw the dipper quickly along under the surface of the milk from one end of the vat to the other, then stir well and there will be no danger of streaks in the curd. Have a dipper with a long handle for the purpose.

Rennet should be diluted to one gallon of pure water for each vat, and the milk should be well stirred for at least five minutes after the rennet has been added. In case the milk is very ripe two minutes will be ample time to stir after adding the rennet.

Everything in and about the factory should be kept scrupulously clean. The cheese-maker who fails to do this need not grumble if his patrons follow his example.

All strainers, sink-cloths, etc , should be well washed, then scalded and thoroughly aired each time they have been used.

The vats, pails, curd-sinks, etc., should be scalded with boiling hot water after washing, and if the water can run out readily they will dry off in a few minutes without wiping. Do not use a dish-cloth, as it usually leaves an unpleasant flavor.

A STARTER.

By A. T. Bell, Instructor in Cheese-making, Tavistock.

A starter is some milk in which the lactic acid has been allowed to develop. In using a starter, first provide a suitable can or vessel for holding it in. A can similar to the ordinary cream gathering can will do, having double walls with hollow space between. It should have two lids, one fitting closely inside of the can with a flange to keep it from going below the shoulder, and the other covering over all and fitting close to the outside.

In preparing the starter use the best cared for milk that comes to the factory ; milk that has been well aired and free from any foreign flavors (it is best to use the same patron's milk). Save out say 20 lb. for each vat at a temperature of 75°, then take about one pound of the previous day's starter for every 25 or 30 lb. fresh milk saved, mix all thoroughly and allow to stand for say one hour, then add about as much water as there is milk. Stir well, cover up close and set it where it will not be disturbed until required for use.

To use, first break it up fine by stirring in the can, then take out what is required, pouring from one pail to another a few times when it will have a creamy consistency and be ready for use.

When to Use a Starter.

Be sure of the condition of the milk before adding the starter, which may be ascertained by applying the rennet test. It may be used with advantage at all times with gassy milk and in cold weather when milk is being delivered at the factory very sweet. If it is known for a certainty that all the milk being delivered into the vat is perfectly sweet, a little may be added on the start, but the bulk should always be kept until the application of the rennet test to ascertain the condition of the milk. Do not run the rennet test so low by 3 or 4 seconds when using a starter.

While a good clean flavored starter is an advantage, a poor flavored one should never be used under any conditions, for it will spoil the flavor of the whole vat.

ONTARIO AGRICULTURAL COLLEGE,

DAIRY DEPARTMENT.

BULLETIN XCIV.

THE CARE OF MILK

FOR

CHEESE FACTORIES AND CREAMERIES

By H. H Dean, B.S.A , Professor of Dairy Husbandry at
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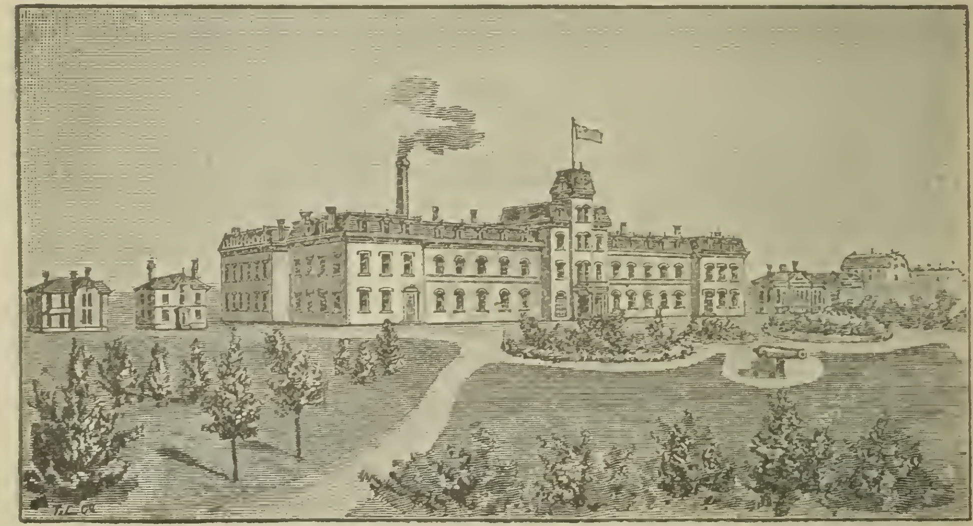

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BULLETIN XCIV.

THE CARE OF MILK

FOR

CHEESE FACTORIES AND CREAMERIES.

That the cheese and butter-makers may be able to make an A 1 article of cheese and butter, it is essential that they be supplied with first-class raw material. It is just as impossible for a furniture dealer to make excellent furniture out of decayed, worm eaten lumber, or the manufacturer of "all wool" goods to make them out of shoddy, as it is for a maker to produce fancy cheese or butter from bad milk.

A cheese-maker of several years' experience said to me recently that the chief faults he found with the milk supplied in his locality were:

1. Want of Aeration.
2. Lack of Straining.

In the older cheese and butter sections, these two are doubtless the points chiefly neglected.

AERATION OF MILK.

Meaning: To aerate milk is to put *air into it*, hence the importance of pure air where this is done. Not only this, but aeration implies the driving off of gases that may be already in the milk. These are most easily driven off while the milk is fresh and warm, and for this reason aeration should be done *at once* after milking and *before* the milk is cooled.

(Note.—Attention is directed to the spelling and pronunciation of this word. In nine cases out of ten it is pronounced as if spelt erry-ation or air-y-ation, whereas it should be pronounced a-ur-ation.)

IMPORTANCE: The flavor of the cheese and butter largely determines the price. The flavor of these depends, with a competent maker, upon the flavor of the milk; therefore, the price depends, to a great extent, upon the flavor of the milk. This something which governs price depends upon proper management of milk at the farm. Proper aeration will get rid of any objectionable odors that may have come from the cow or food. Where paying by test is practised, aeration and stirring will prevent the cream from rising, and consequently the milk will give a higher average test and one more uniform.

HOW TO AERATE: It may be done by dipping, pouring or stirring or by the use of an aerator. An aerator properly used is a help, but abused, it is a hindrance. Simply running milk through an aerator once after milking without any further stirring is not sufficient. It should be stirred two or three times at intervals of 10 or 15 minutes after being put through one of these aerators and again before going to bed. Not only to improve flavor should this be done, but also to prevent loss of cream in the vats, especially in the fall, when milk frequently stands some time before being set.

Some keep their milk over night in pails hanging on hooks. These hooks are fastened to a strong pole or scantling supported by means of a couple of posts in the ground.

The morning's milk needs aerating as well as the evening's.

AERATORS SHOULD BE KEPT CLEAN: Look out for grease and dirt in nooks and crevices. Do not buy an aerator that is not easily cleaned. One good maker in Western Ontario does not advise the use of aerators at all, for the reason that patrons do not keep them clean.

A good thing for purifying milk may be made by taking an ordinary shallow milk pan made of strong tin. On the outside bottom of this, fasten a handle about 2½ feet long. Punch 8 or 10 small holes in the bottom of the pan. In using, put the inverted pan squarely down into the milk and allow this pan of air to bubble through the milk. When it ceases bubbling, draw out and then insert again. Do this a dozen times each evening and morning. The evening milk should be treated about three times in the foregoing manner, once immediately after milking, then in 15 minutes, and again in about half an hour. Stir before retiring for the night.

STRAINING.

WHEN TO COMMENCE: Straining *should begin before commencing to milk*, by brushing off all dirt, hairs, straw, etc., from the udder, teats and body of the cow. Let it be the duty of some one person to go over all the cows with a soft brush, or a damp cloth, before the cows are milked.

HOW TO STRAIN: An ordinary wire sieve strainer does very well, but we add to this by doubling cheese cloth or thin cotton so as to have four thicknesses. Lay the cloth across the bottom of the strainer and then fasten it on by means of a tin ring which slips over the cloth and bottom part of the strainer. For quickness we use a strainer that a pail of milk may be put into at once. This sits in a wooden frame over the can. Some use a woollen cloth to strain with. Cloth of some kind is necessary to catch hairs and fine dirt. This cloth must be kept clean. Scald it thoroughly each time after using.

WHY STRAIN? Cheese and butter are articles of food to be eaten by men and women. A great many forget this. They seem to think that it does not make any difference what kind of milk is sent to the factory, judging from what may be seen on the strainers of factories. It all goes—well, goes somewhere, and they do not eat it.

OTHER POINTS TO BE OBSERVED.

1. Keep none but cows that will give at least 6,000 pounds of milk or 250 pounds of butter a year. Weed out the poor ones and replenish the herd by raising calves from the best. Send milk to the factory from none but healthy animals. When a cow shows symptoms of not doing well, she should be separated from the rest of the herd and her milk not used for food.

2. Colostrum, or the first milk after calving, should not be sent to make either cheese or butter. Not until the fifth day does the milk become normal. Previous to this it contains a high percentage of albumen, which is of no use to either the cheese or the butter-maker, but is a decided hindrance.

3. In the spring and fall, while the cows are in the stable, it should be kept clean. To keep a stable clean, the following are necessary: Two brooms—a stable and a house broom; tight floors;

land plaster for the gutter; lime for sprinkling around the passages; whitewash for ceilings and walls. Let the men borrow a little whitewash and a brush for an hour from the women this spring, go down to the cow stable, sweep off the cobwebs and dust that have accumulated there ever since the stable was built; whitewash 10 square feet, and then if it is thought to be a waste of lime and labor, don't do any more this spring, but observe the contrast with the rest of the stable. A cow stable is a place for a cow to *live* in, not to exist in. The health of men and women depend, to a large extent, upon the cow; the health of the cow depends largely on her house being properly aired and cleaned; therefore the health of children and men depends in a great measure on how the cow stable is looked after. Aim to keep it as clean and pure as the house. In addition there is need of some handy method of cleaning the stable *twice* a day when the cows are in all the time, and somebody to make use of the things mentioned.

4. While in the stable, cows need currying and brushing once a day. If more time is spent in brushing the cows and less, if necessary, in brushing horses, it will pay better at present.

5. Feed nothing but pure, sweet, clean, wholesome food. Anything which gives a taint or bad flavor to milk should not be given to cows. If a taint or flavor in the milk is caused by the food, it will be at its worst when drawn from the cow; if caused by some fermentation, it will grow worse as the milk is kept. The remedy for the latter is cleanliness. Use scalding water in washing the utensils and strainers. The following foods are prohibited in the dairy: Sour brewers' grains, distillery slops, Swede turnips and tops, rape, sour mouldy silage, musty meal, cleanings from the horse stable, and hay or grass having bad smelling weeds, such as leeks or rag-weed. Allow cows access to plenty of pure water and salt at all times.

6. Milking needs to be done by clean persons. Hands should be washed before commencing to milk. Have a wash basin, some soap, water and a towel in the stable and use them. Clean aprons to put on while milking will be useful. Milk each cow regularly and milk out clean. It will pay to "strip" the cow a minute longer than usual, if you are being paid by test.

7. After straining and aerating, the milk may be cooled for the creamery. For the cheese factory it is not necessary, except during very hot weather. The milk may as well be ripening while the maker is sleeping, as to have him sitting around waiting for it to ripen during the day.

8. Set the milk can in a place where the air is pure, and in winter where it will not freeze. Milk should be protected from sun and rain. These are good in their place, but poor things to make cheese and butter out of.

9. The milk stand should be 100 feet from the barnyard and from where pigs are fed. It should have a cover allowing a free circulation of air, at the same time preventing the milk from being heated, or allowing rain water to get into it. Rain water is said to spoil the flavor.

10. Milk wagons should be kept clean. The boxes or racks for holding the cans need scrubbing with hot water once a week to remove spilled milk, etc. This is especially necessary where whey is hauled on the same wagon as the milk. The odor of some milk wagons is sufficient to taint the milk. The horses need proper grooming that no odors from them reach the milk. The driver and his clothing should be clean and tidy. Cans of milk protected from sun and dust while on the road will reach the factory in better condition than those without cover.

11. If the can is ten years old and rusty, leaks badly, has a dinged cover, and spills one half a gallon or more milk every day it is sent to the factory, should you continue to use it? Will it not pay to buy a new one?

12. Where possible, insist on the whey being returned in the milk cans. (Sour whey, alone, is an excellent article to keep pigs in good squealing condition). Let it stand in the can until just before commencing to milk, then empty, rinse very slightly with warm—not hot—water. Put the evening's milk at once into this can without straining and aerating. If it gets to the factory before it sours, step into the factory about noon and hear the cheese-maker give an exhortation on gassy curds and whey ("bucky," some call it) flavors. Observe the look on his face which says, "If I get through by 8 or 9 o'clock to night, I'll do pretty well." Come round again in about a month and see the buyer look at the cheese made from the vat into which but *one* can of such milk was emptied, and notice him set this cheese aside for further inspection or a lower price He may refuse it altogether for export. It will do for the home market and will have a great tendency to develop home consumption.

If the patron who sends milk like the foregoing suffered alone, it would not be so bad; but if it is taken in by the maker out of pity, every patron of the factory has to bear the consequences. This is bearing one another's (useless) burdens.

13. To wash milk pails, milk cans, strainers, etc., they should be first rinsed in lukewarm water, next washed with hot water, and then be scalded, after which, put them in a nice place to air and dry. Do not wipe dairy tinware with a dishcloth. Make a bonfire of all the old dishcloths that are used for wiping dairy utensils and the flavor of the milk will go up 10 per cent.

14. Milk should be sent to the factory of the same quality as given by the cows. Nothing should be added to the milk and nothing taken from it (except bad odors). Removal of cream, keeping back "strippings" or skim milk, or "first milk," should be prohibited. It is as great a crime to keep home skim-milk, or the "first milk" from a cheese factory as it is to keep home cream or "strippings." Adulterated milk is milk to which anything has been added, or from which anything has been taken. Persons offering for sale such milk should be prosecuted.

15. The patrons having done everything to supply the makers with good, pure milk, it is the duty of the factoryman to make first-class goods. Patrons! step into your factory occasionally and see that everything is neat and clean in and around it, and that there is good cheese or butter on the shelves or in the storeroom. If it is not so, ask why, and if the defect is not remedied, insist on a change of maker next year.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, ONT.

BULLETIN XCV.

EXPERIMENTS IN CHEESE-MAKING

By H. H. Dean, B.S.A., Professor of Dairy Husbandry.

BULLETIN XCVI.

THE COMPOSITION OF MILK, CHEESE AND WHEY IN RELATION TO ONE ANOTHER.

By A. E. Shuttleworth, B.S.A., Professor of Chemistry.

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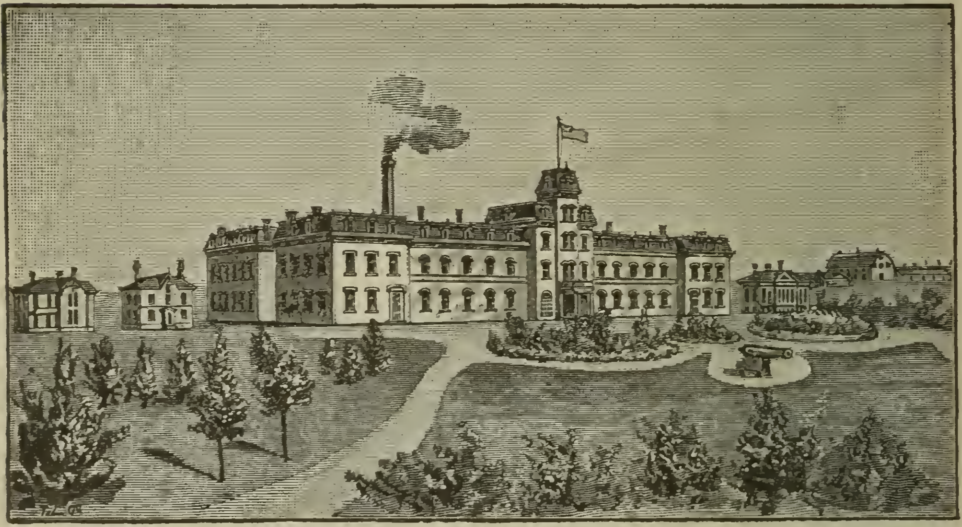

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BULLETIN XCV.

EXPERIMENTS IN CHEESE-MAKING.

By H. H. Dean, B. S. A., Professor of Dairying.

The question, which is better, to pay patrons of cheese factories according to the percentage of fat in their milk, or to pay them according to weight of milk? having been very much discussed at dairy conventions, farmers' institutes, and in the press, it was decided to conduct, at the dairy department of the College, during the present year, a series of experiments bearing on the point at issue. Besides this, we have asked about 75 cheese-makers in different parts of the Province to co-operate with us in the work. The plan of the experiment is to make cheese at the dairy here for one week of each month throughout the season, beginning with May. The cheese-makers have been asked to make one experiment each month and send in the report on blank forms furnished by the Experimental Union in connection with the College.

We select normal milk with as wide a variation in the percentage of fat as we can get. Most of the milk used here has been supplied by our Dairy and Farm herds. In addition, we bought about 150 pounds per day from neighboring farmers. In all, five herds have contributed the milk used in the May and June experiments, which are here reported. Most of our cows give milk of good quality. We test each cow weekly by composite tests, and put the milk from all the cows testing over 3.6 per cent. into one can, and the milk testing under this into another can. To supplement this, a quantity sufficient to make up 600 pounds per day has been bought—chiefly poor milk. The chemical analyses of milk, whey, green cheese, and cured cheese are made from month to month in the chemical laboratory.

The quantity of milk in each vat was 300 pounds. Two such vats of milk were made into cheese each day, under the same conditions as far as possible. The percentage of fat in milk and whey was determined by the Babcock method at the Dairy. One ounce of rennet, diluted in 4 ounces of water, was used for each 300 pounds of milk in both May and June. No coloring was used in the milk. A rennet test was made of each vat every day. In making the test we added 1 dram of Hansen's Rennet Extract to 8 ounces of milk at a temperature of 86°F., and noted the time required for coagulation. During the month of May the rennet test varied from 9 to 18 seconds, with an average of 14 when set. In June the tests varied from 14 to 18 seconds—average 16.

The temperature at which the milk was set varied from 85° to 90°, but nearly all the vats were set in both months at 86°. The time required for coagulation varied from 11 to 28 minutes—average 19 minutes in May; in June the variation was from 20 to 30 minutes, with an average of 23 minutes. All the curds were heated to 98° for cooking. They were dipped on showing about one-eighth of an inch of acid on the hot iron. All curds were milled with the Harris mill, and at a time about half-way between dipping and salting. In May the salting was done at the rate of 2 pounds per 1000 lbs. of milk. During June all curds were weighed when ready and salted at the rate of 2½ pounds per 100 pounds of curd. They were put to press in 15 or 20 minutes after salting. Pressure was applied lightly at first in a "gang" press, having a "spring head;" and after 40 to 60 minutes the cheese were bandaged and put back to press for about 20 hours. All cheese were weighed green with one press cloth on, and then put into the curing room. The May cheese were weighed again on June 2nd, and the June cheese on July 2nd.

In spite of extra care taken of our own milk, some of the curds developed a peculiar flavor, and some were slightly gassy. A "starter" was used in some cases to hasten the ripening of the milk.

The table shows the difference in yield of cheese from milk with different percentages of fat for the two months. Three hundred pounds of milk were used in each case.

Date.	Per cent. fat in wholemilk	Lb. cheese.		Loss in curing.	Lb. milk for 1 lb. green cheese.	Lb. green cheese for 1 lb. fat in milk.
		Green.	Cured.			
				lb.		
April 30th..	3.90	30.00	28.25	1.75	10.00	2.56
	3.35	27.50	25.50	2.00	10.91	2.74
May 1st....	3.90	29.50	27.50	2.00	10.17	2.52
	3.60	27 00	24.50	2.50	11.11	2.59
" 2nd....	3.60	29.75	27.50	2.25	10.08	2.76
	3.50	27.75	25.75	2.00	10.81	2.64
" 3rd....	3.85	29.00	27.50	1.50	10.34	2.51
	3.40	28.00	26.50	1.50	10.71	2.75
" 4th....	3.70	29.00	27.50	1.50	10.34	2.61
	3.70	29.00	27.50	1.50	10.34	2.61
" 5th....	4.00	30.00	28.75	1.25	10.00	2.50
	3.50	28.00	27.50	0.50	10.71	2.67
" 7th....	3.65	29.25	27.75	1.50	10.26	2.67
	3.30	27.50	26.00	1.50	10.91	2.75
June 4th....	4.50	33.75	31.25	2.50	8.88	2.50
	3.20	28.25	26.25	2.00	10.62	2.94
" 5th....	3.80	31.25	29.50	1.75	9.60	2.74
	3.40	30.00	28.25	1.75	10.00	2.92
" 6th....	4.10	32.75	31.00	1.75	9.16	2.66
	3.60	29.75	28.00	1.75	10.08	2.75
" 7th....	4.20	32.75	30.75	2.00	9.16	2.59
	3.80	32.50	30.50	2.00	9.23	2.85
" 8th ...	4.10	32.50	30.75	1.75	9.23	2.64
	3.70	31.00	28.75	2.25	9.67	2.79
" 9th....	4.40	32.50	30.50	2.00	9.23	2.46
	3.90	29 75	28.25	1.50	10.09	2.55

The average percentage of fat for the seven days, April 30th to May 7th, was for one vat 3.80 and for the other 3.48. There were

2,100 lb. of milk used altogether in each vat. This amount of milk, testing 3.80 per cent fat, made 206.5 lb. green cheese and 194.75 lb. cured cheese. The loss in curing was 11.75 lb. The average number of lb. green cheese made from 300 lb. milk was 29.5. The lb. of milk for one pound of green cheese was 10.03—cured cheese 10.77. The lb. of green cheese made for one pound of fat in the milk were 2.59. The average loss of fat in the whey as determined by the Babcock method, was 0.26 per cent.

The other vat (2,100 lb.), averaging 3.48 per cent. fat, made 194.75 lb. green cheese—183.25 cured—loss in curing 11.5 lb. The average number of lb. of green cheese made from 300 lb. of milk was 27.82. The lb. of milk for one pound of green cheese were 10.78—cured cheese 11.46. The lb. green cheese for one lb. fat in the milk were 2.68. The average percentage of fat in the whey was 0.25.

During the June experiments the vat of "rich" milk averaged 4.18 per cent. fat. 1,800 pounds of milk were used, which made 195.5 lb. green cheese--183.75 cured—loss in curing 11.75 lb. The average lb. cheese from 300 lb. milk were 32.58 green, 30.62 cured. The average lb. milk required to make 1 lb. cheese were 9.21 green, 9.79 cured. The average amount of cheese produced for 1 lb. fat in the milk was 2.60 lb. green and 2.44 lb. cured. Per cent. of fat in whey 0.19.

The vat of "poor" milk averaged 3.60 per cent. fat. 1,800 lb. milk made 181.25 lb. green cheese—170 cured ; loss 11.25 lb. 300 lb. milk made 30.21 lb. green cheese—28.33 cured. Pounds of milk to make 1 lb. cheese, 9.95 green—10.59 cured. One pound of fat made 2.80 lb. green cheese—2.62 cured. Fat in whey, 0.19 per cent.

The cheese made from the "rich" and "poor" milk was scored by two competent judges. The following is the scale of points used by them :

Flavor	35
Closeness	20
Even color	15
Texture	20
Finish	10
	100

All cheese were scored full points for finish. The average score of the two judges of the cheese made from "rich" milk (3.80 per cent. fat) in May was 83 points. Cheese from "poor" milk (3.48 per cent. fat) scored 84 points. The cheese of June experiments were judged on July 6th by the same men. The average score of "rich" milk cheese (4.18 per cent. fat) was 91 ; that made from milk averaging 3.60 per cent. fat scored 93 points. The two cheese which scored the highest number of points in May and June were made out of milk testing 3.2 and 3.4 per cent. fat.

It is yet too soon to draw definite conclusions from our work, but so far it would indicate:

1. An increased percentage of fat in the milk gives an increased yield of cheese, though not in the same proportion.

2. That a pound of butter-fat in milk ranging from 3.2 to 3.7 per cent. will make more cheese than a pound of fat in milk ranging from 3 6 to 4.5 per cent. of fat.

3. That there need not necessarily be more loss of fat in whey from rich milk up to 4.5 per cent. fat than from poor milk, though we did notice a little more "grease" on the hoops, press and shelves from the rich milk cheese (4.5 per cent. fat).

4. That milk containing the same per cent. of fat, does not always give the same yield of cheese, especially when comparing one day with another or one month with another. April 30th, 300 lb. of 3.9 per cent. milk made $28\frac{1}{4}$ lb. cured cheese; May 1st, same quantity and quality of milk made $27\frac{1}{2}$ lb.; June 9th it made $28\frac{1}{4}$ lb. May 1st, 300 lb. of 3.60 per cent. milk made $24\frac{1}{2}$ lb. cured cheese; May 2nd, $27\frac{1}{2}$ lb.; June 6th, 28 lb. May 4th both vats tested 3.7 per cent. and each made $27\frac{1}{2}$ lb. cured cheese. June 8th, 3.7 per cent. milk made $28\frac{3}{4}$ lb. cheese.

This question has been a vexing one in factories, where payment by test has been adopted. It has been found that the yield of cheese does not always increase with the fat, and the discrepancy is doubtless due to differences in conditions of milk, methods of making, and state of the weather.

As some of our factories are still in doubt as to the advisability of distributing proceeds among patrons according to the percentage of fat in the milk, perhaps the following table will throw some light on the question:

Patron.	lb. milk.	Per cent. fat in milk.	Wt. cheese. lb.	Amount of money each would receive if cheese sold for 10c. per lb.				
				Paying by wt. of milk.	By per cent. fat.	By Reading + 1 per cent.	By Reading + 2 per cent.	By wt. of cheese made.
				$ c.	$ c.	$ c.	$ c.	$ c.
May:								
H.	2,100	3.80	194.75	18.90	19.73	19.54	19.44	19.475
L......	2,100	3.48	183.25	18.90	18.06	18.25	18.37	18.325
June:								
H.................	1,800	4.18	183.75	17.685	19.01	18.73	18.56	18.37
L..	1,800	3.60	170.00	17.685	16.36	16.64	16.81	17.00
July:								
H.................	1,800	3,84	184.00 (green)	17.41	18.91	18.58	18.37	18.40
L..........	1,800	3.23	164.25 (green)	17.41	15.91	16.24	16.45	16.42

In the table we have assumed that H. and L. are patrons, and during the months of May, June, and July they furnished milk with the percentages of fat given. This milk was made up separately, so that we know how much cheese was made in each vat, or was furnished by each patron. Assuming that all the cheese netted the patrons ten cents a pound, if we divided the money between them according to the amount of milk sent, both of them would receive exactly the same amount of money, because the same quantity of milk was used in each vat. As the milk was made up separately (which would be the correct way in a factory if it were practicable, as every patron would have just the quantity and quality of cheese his milk entitled him to) we know the money value of the milk used in the vats. This is seen in the last column. If we compare the amounts of money in the first and second columns with those in the last, we find that neither of them gives justice, though the second (that according to the per cent. of fat in the milk) is much nearer than the first.

It has been felt by practical men that paying according to the fat alone, gives the patron who furnishes rich milk more than his just share of the proceeds, and the patron sending poor milk less than he is entitled to. The table would seem to indicate that this view is correct.

To overcome this difficulty it has been suggested by one of our prominent young dairymen of western Ontario, to add one per cent. to each man's butter-fat reading. For instance, a patron who sends an average of 4 per cent. milk, call his test 5 per cent.; and one who sends 3 per cent. milk call it 4; and so on with all the tests. When this was first suggested, I was not favorably inclined towards the plan; but the results as seen in the table would seem to indicate that adding one or even two per cent. to the fat readings in these tests is more nearly correct than paying by weight of milk or by the fat alone.

We shall have further data on this point, and in the meantime we ask the co-operation of all cheese-makers and factories who are paying by test to help to settle the question, as it is one that affects all patrons. Every factory that has a tester, should select the patrons' milk and put the poor milk in one vat and the rich in another. Note the per cent. fat, weight of milk used, yield and quality of cheese made from each, and send the results to the Dairy Department of the Ontario Agricultural College, Guelph. From the data thus secured we can more nearly arrive at the just method for all. Let every factory be a small experiment station until this point is settled.

BULLETIN XCVI.

THE COMPOSITION OF MILK, CHEESE, AND WHEY IN RELATION TO ONE ANOTHER.

By A. E. Shuttleworth, B.S.A., Professor of Chemistry.

An extensive chemical analysis of milk, cheese, and whey was begun by us early in May last, to study the constituents of milk in their relation to the yield of cheese. This line of study was suggested by the excellent work upon the investigation of cheese commenced at Geneva, N.Y., in 1891, and by important conclusions drawn therefrom. It is to study this question from the standpoint of Ontario conditions, as well as to bring new facts to light, that this line of chemical investigation has been entered into.

The principal points of the present investigation are:

1st. The degree of uniformity in the proportion of fat to casein in our milk.

2nd. The relation of the fat contained in our milk to its cheese-producing power.

3rd. The proportion of the fat of the milk lost in whey by our method of cheese-making.

4th. Fat as a basis in apportioning dividends to patrons.

5th. The average composition of our milk, cheese, and whey.

Compounds Contained in Milk, Cheese, and Whey.

Water. Milk contains about 87.6, cheese 34.6, and whey 93.4 per cent. of water.

Fat. The fat of milk, cheese, and whey is a mixture of glycerol salts of several acids, and is the same substance that forms so large a portion of natural butter. Milk contains about 3.5, cheese 35.5, and whey 0.24 per cent. of fat.

Casein. This is the chief nitrogenous substance in milk, and is commonly called curd. This curd or casein can be precipitated in milk by acids or by the use of rennet. Milk contains about 2.3, cheese 22.1, and whey 0.13 per cent. of casein.

Albumen. Albumen is similar in composition to casein; but, unlike it, is not thrown down or made insoluble by acids or the action of rennet. In cheese-making, the albumen passes more or less completely into the whey. The amount in milk is about 0.7, in cheese 1, and in whey 0.76 per cent.

Total Solids. By this term are meant all the compounds (except water) taken together.

		Per cent. of water.			Per cent. of solids.			Per cent. of fat.		
LOT H.		Milk.	Cheese.	Whey.	Milk.	Cheese.	Whey.	Milk.	Cheese.	Whey.
May 2nd	I	87.756	36.061	93.170	12.244	63.939	6.830	3.474	33.775	.125
	II	88.235	35.752	93.747	11.765	64.248	6,253	4.325	31.619	.183
Average		87.995	35.906	93.458	12.005	64.090	6.542	3.899	32.697	.154
May 7th.. ...	I	87.743	35.931	93.180	12.257	64.069	6.820	3.462	32.994	.406
	II	88.061	36.089	94.902	11.837	63.911	5.098	3.908	..	.350
Average......		87.902	36.010	94.042	12.098	63.990	5.958	3.685	32.994	.375
June 4th......	I	87.343	34.700	92.920	12.657	65.300	7.080	4.387	37.687	.216
	II	86.710	34.052	92.952	13.290	65.948	7.048	4.290	38.601	.191
Average.....		87.026	34.376	92.936	12.973	65.624	7.064	4.338	38.144	.203
June 6th	I	86.893	33.628	......	13.108	66.372	......	3.660	36.546	.....
	II	86.875	33.287	......	13.125	66.713	......	3.650	35.437	....
Average......		86 883	33.457	......	13.116	66.543	......	3.655	35.991	.....
June 8th	I	87.081	34.747	93.269	12.919	65.253	6.731	4.004	34.274	.186
	II	87.142	35.115	......	12.858	64.885	.....	3.996	33.961	.210
Average......		87.111	34.931	93.269	12.888	65.069	6.731	4.000	34.117	.198
Average of all		87.383	34.936	93.426	12.616	65.063	6.574	3.915	34.788	.232
LOT L.										
May 2nd	I	87.897	35.216	93.175	12.103	64.784	6.825	3.446	33.806	.120
	II	87.951	35.167	93.200	12.049	64.833	6.800	3.518	34.456	.164
Average......		87.924	35.191	93.187	12 076	64.809	6.813	3.482	34.131	.142
May 7th.... .	I	88.086	36.117	93.196	11.914	63.883	6.804	3.237	33.221	.249
	II	88.166	36.167	93.191	11.834	63.833	6.809	3.149	32.201	.325
Average......		88.126	36.142	93.193	11.874	63.858	6.807	3.193	32.211	.287
June 4th	I	88.113	35.682	......	11.887	64.318	......	3.091	33.872	.214
	II	88.119	35.001	95.180	11.881	64.999	4.820	3.070	34.525	.210
Average......		88.116	35.341	95.180	11.884	64.659	4.820	3.080	34.196	.212
June 6th	I	87.837	35.021	......	12.163	64.979	......	3.140	35.126	......
	II	87.680	34.779	......	12.320	65.221	......	3.248	35.087	......
Average......		87.758	34.900	......	12.194	65.100	......	3.194	35.106	......
June 8th	I	87.469	35.700	94.032	12.521	64.300	5.968	3.564	33.584	.205
	II	87.425	35.804	93.399	12.575	64.196	6.601	3.564	33.468	.235
Average......		87.447	35.752	93.715	12.548	64.248	6.284	3.564	33.526	.220
Average of all		87.874	35.465	93.819	12.115	64.535	6.181	3.302	33.834	.215

Milk, Cheese and Whey.

Per cent. of casein.			Per cent. of albumen.			Pounds green cheese from 100 lb. milk.	Ratio of cheese to milk.	Lot H.
Milk.	Cheese.	Whey.	Milk.	Cheese.	Whey.			
2.181	17.337	.356	.744	......	.412	......	.....	I } .... May 2nd.
......	......	.355	.....	......	.332	.....	......	II
2.181	17.337	.355	.744	......	.372	9.91	1:10.0	.... Average.
2.280	21.712	.068	.757	2.356	.800	......	......	I } .... May 7th.
2.230	22.725	.068	.588	1.037	.813	......	......	II
2.255	22.218	.068	.672	1.697	.806	9.75	1:10.2	.... Average.
2.445	20.981	.039	.561	.956	.892	......	.....	I } .... June 4th.
2.445	20.800	.071	.742	1.300	.822	.....	.....	II
2.445	20.890	.055	.651	1.128	.857	11.25	1: 8.8	.... Average.
2.556	22.903	......	.725	.609	......	......	.....	I } .... June 6th.
2.181	22.868	......	1.056	.713	......	......	......	II
2.368	22.885	......	.891	.661	......	10.91	1: 9.1	.... Average.
2.631	22.025	.143	.491	.706	.757	.....	......	I } .... June 8th.
2.162	22.356	.151	.971	.837	.744	.....	......	II
2.396	22.190	.147	.781	.772	.750	10.83	1: 9.2	.... Average.
2.329	21.104	.156	.747	1.064	.696	10.53	1: 9.4	.... Average of all.
								Lot L.
2.131	17.212	.200	.694	......	......	......	.....	I } .... May 2nd.
2.081	......	.187	.637	......	......	......	......	II
2.106	17.212	.193	.665	2.568	......	9.25	1:10.8	.... Average.
2.380	21.931	.100	.651	......	.800	......	......	I } .... May 7th.
2 460	......	.093	.477	......	.913	.....	......	II
2.420	21.931	.096	.564	1.572	.875	9.19	1:10.8	.... Average.
2 176	22.162	.065	.730	1.769	.985	.....	......	I } .... June 4th.
2.256	23.034	.065	.556	1.103	.891	.....	......	II
2.216	22.598	.065	.643	1.436	.938	9.42	1:10.6	.... Average.
1.993	22.381	......	......	.725	......	......	......	I } .... June 6th.
2.100	21.525	......	......	2.100	......	......	.. ...	II
2.046	21.953	.....	.779	1.412	.. ..	9.92	1:10.0	.... Average.
2.3 62	20.637	.068	.831	......	.889	.....	......	I } .... June 8th.
2.2 93	......	.059	.963	......	.890	.. ...	.....	II
2.3 27	20.637	.063	.897	1.359	.889	10.33	1: 9.6	.... Average.
2.223	20.866	.104	.709	1.669	.900	9.62	1:10.3	.... Average of all.

PLAN OF SECURING SAMPLES FOR ANALYSIS.

The milk used was from our herd of 20 cows. Each cow's milk was tested with a Babcock tester as soon as drawn, and the milk from the herd divided into two lots according as it indicated a high or a low per cent. of fat. Lot L. represented milk low in fat; lot H. milk high in fat. In addition, milk was purchased from two or more neighboring farmers and added to lot L. or H., according to whether the per cent. of fat was low or high. After being thoroughly mixed, 300 pounds were taken from each lot and put into separate vats to be made into cheese. From each vat a sample for chemical analysis was taken; and to replace these samples, equal quantities from lots L. and H. were added to their respective vats. The milk of each vat, being exactly 300 pounds, was made into cheese by a skilful maker, under exactly similar conditions. Cheese was made in this way every day during the first week of May and of June. Samples of milk were taken for analysis on the 2nd and 7th days of May, and 4th, 6th, and 8th days of June. The cheese and whey of these dates were also sampled and analyzed. The preceding tables give duplicate analyses of these samples of milk, cheese and whey.

Lot H. represents the rich milk, in which the per cent. of fat is 3.915. It took an average of 9.4 pounds of this milk to make one pound of cheese. Lot L. represents the poor milk, containing 3.302 per cent. of fat and requiring 10.3 pounds of milk to make one pound of cheese. Out of the preceding tables we have selected all the full duplicate analyses and have made from them our general averages for milk, whey, green cheese, and cheese one month old. In table given below these averages are compared with American averages.

Table showing average composition of milk, whey, and cheese.

—	Water.	Total solids.	Fats.	Casein.	Albumen.	Sugar, ash, etc.
Milk.						
Average of 18 duplicate determinations of 9 distinct samples	87.687	12.318	3.546	2.279	0.704	5.789
Average for 1893 at 48 American factories	87.280	12.72	3.77	2.48	0.69	5.78
Whey.						
Average of 12 duplicate determinations of 6 distinct samples	93.435	6.564	0.239	0.130	0.759	5.436
Average for 1893 at 48 American factories	93.00	7.00	0.38	0.86		5.76
Green Cheese.						
Average of 10 duplicate determinations of 5 distinct cheeses	34.601	65.399	35.511	22.103	1.082	6.703
Average for 1893 at 48 American factories	36.84	63.16	33.90	23.32	......	5.94
Cheese one month old.						
Average of 12 duplicate determinations of 6 distinct cheeses	32.529	67.471	36.061	18.607	5.328	7.475

The above table shows a marked degree of uniformity between Canadian and American averages.

As a check upon the amount of the fat of the milk retained in the cheese, fat determinations of cheese were made directly, and also by difference between the fat lost in the whey and that contained in the milk. Making allowances for the difficulty of determining accurately the fat in cheese, owing to its somewhat uneven distribution, the figures in the last two columns of the following table, obtained by direct determination and by difference, agree closely, and point to a conclusion entirely in accordance with that arrived at by the Geneva station, viz., that "the loss of fat in cheese-making is quite independent of the amount of fat in milk." Another feature brought out in this table, and one which reflects credit upon the maker, is the small amount of the fat of the milk lost in the whey.

Table showing pounds of fat in cheese and whey from 300 pounds of milk.

	Date.	Pounds of milk.	Per cent. of fat in milk.	Pounds of fat in 300 pounds of milk.	P'nds of cheese from 300 p'nds of milk.	Pounds of fat in yield of whey.	P'nds of fat in yield of cheese.	
							By direct de-terminat'n.	By difference.
L	June 4	300	3.080	9.24	28.25	.58	9.66	8.66
	May 7	300	3.193	9 58	27.50	.78	8.86	8.80
	June 6	300	3.194	9.58	29.75	....	10.44	......
	May 2	300	3.482	10.45	27.75	.39	9.47	10.06
	June 8	300	3.564	10.69	31.00	.59	10.39	10.10
H	June 6	300	3.655	10.97	32.75	....	11.79	......
	May 7	300	3.685	11.06	29.25	1.02	9.65	10.04
	May 2	300	3.899	11.70	29.75	.41	9.73	11.29
	June 8	390	4.000	12.00	32.50	.53	11.09	11.47
	June 4	300	4.338	13 01	33.75	.54	12.87	12.47

The best method of paying for milk delivered at cheese factories is a subject of great importance to cheese-makers and patrons of cheese factories. Certainly the old method, viz., that of paying for milk according to weight alone, is not satisfactory. Of late there is a tendency, particularly among American cheese men, to pay according to the amount of fat contained in the milk. The justice of this method evidently depends upon the constancy between the per cent. of fat and the yield of cheese.

Per cent. of fat.		Per cent. of casein.	Ratio of fat to casein.
L.	3.080	2.216	1 : 0.71
	3.193	2.420	1 : 0 75
	3.194	2.046	1 : 0 64
	3.482	2.106	1 : 0.60
	3.564	2.327	1 : 0.65
L., average	3.302	2.223	1 : 0.67
H.	3.655	2.368	1 : 0.65
	3.685	2.255	1 : 0.61
	4.000	2.396	1 : 0.59
	4.338	2.445	1 : 0.56
H., average	3.919	2.366	1 : 0.60

In this table the percentages of fat are arranged in the order of their amounts in both L. and H., giving a range from 3.080 in L. to 4.338 in H. In this table also the L. and H. samples are separately grouped to give an average for L. samples, representing milk low in fat, and for H. samples, representing milk high in fat. An examination of the figures under "ratio of fat to casein" reveals a gradual decrease with some variation in the proportion of casein to fat as the milk increases in richness. By comparing the groups it will be seen that L., with an average of 3.302 per cent. of fat, gives on an average 0.67 of one pound of casein to one pound of fat; and H., with an average of 3.919 per cent. of fat, gives on an average 0.60 of one pound of casein to one pound of fat. While it would not do to conclude hastily from these tests, covering only one week in each of two months, that milk containing 4 per cent. of fat contains less casein in proportion to its fat, than milk which contains 3 per cent. of fat, still it must be admitted that these results point in that direction. Below is given the results of tests along this same line made by the Geneva Station (Bulletin 68, New Series). Samples of milk were collected once each week through the entire season from the herd which gave milk richest in fat and also from the herd which gave milk poorest in fat. The average results secured from each of these two herds during the season were as follows :

——	Average per cent. of fat in milk.	Average per cent. of casein in milk.	Pounds of casein for one pound of fat in milk.
Herd giving milk poorest in fat	3.33	2.20	0.66
Herd giving milk richest in fat	4.08	2.57	0.63

These results show that the milk poorest in fat contained a trifle more casein for each pound of fat in milk; but, for all practical purposes, the results may be regarded as showing uniformity in the relation of fat to casein in factory milk from different herds.

Our averages for the milk poorest in fat and for the milk richest in fat are practically the same as those of the Geneva poorest and richest milk; their tests cover one day of every week throughout the season and our tests cover the first week of May and of June; the conclusions drawn from their results and from ours are the same, viz., that the poorest milk contains more casein for each pound of fat, but Geneva found a difference of 0.03, while we found a difference of 0.07.

Table showing relation of fat in milk to yield of cheese.

	Date.	Per cent. of fat in milk.	Pounds of fat in 300 pounds of milk.	Pounds of green cheese made from 300 pounds of milk.	Ratio of fat to green cheese.
L	June 4........	3.080	9.240	28.25	1 : 3.0
	May 7........	3.193	9.579	27.50	1 : 2.8
	June 6........	3.194	9.582	29.75	1 : 3.1
	May 2........	3.482	10.446	27.75	1 : 2.6
	June 8........	3.564	10.692	31.00	1 : 2.8
Total.............		....	49.539	144.25	1 : 2.9
H	June 6........	3.655	10.965	32.75	1 : 2.9
	May 7........	3.685	11.055	29.25	1 : 2.6
	May 2........	3.899	11.697	29.75	1 : 2.5
	June 8....... .	4.000	12.000	32.50	1 : 2.7
	June 4...	4.338	13.014	33.75	1 : 2.5
Total..................		....	58.731	158.00	1 : 2.6

From the milk having more casein for each pound of fat, more cheese for each pound of fat would be expected, than from the milk having less casein for each pound of fat. What are the facts? Fifteen hundred pounds of milk L., containing an average of 3.302 per cent. of fat or a total of 49.539 pounds, yields 144.25 pounds of green cheese, being 2.9 pounds of cheese for each pound of fat. The same weight of milk H , containing an average of 3.919 per cent. of fat or a total of 58.731 pounds, yields 158 pounds of green cheese, being 2.6 pounds of cheese for each pound of fat. Under exactly similar conditions of handling, the rich milk yields $13\frac{3}{4}$ pounds more cheese than the poor milk, but the poor milk makes $\frac{3}{10}$ of one pound of cheese more for every pound of fat than does the rich milk.

Suppose L. and H. to represent two patrons, each supplying 1,500 pounds of milk. L.'s milk yields 144.25 pounds of cheese and H.'s milk 158. Then, if the cheese nets 9 cents, patron L. should receive 144.25 × 9 or $12.98; and H., 158 × 9 or $14.22. Had these patrons been paid according to weight of milk alone, each would have received equal shares. In all, 302.25 pounds of cheese were made, netting 9 cents a pound, 302.25 × 9 = $27.20 would be divided equally, each patron receiving $13.60. Accordingly, patron L., supplying the poor milk, would be paid 62 cents too much, and patron H. 62 cents too little.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, ONT.

BULLETIN XCVII.

EXPERIMENTS WITH WINTER WHEAT

By C. A. Zavitz, B.S.A., Experimentalist.

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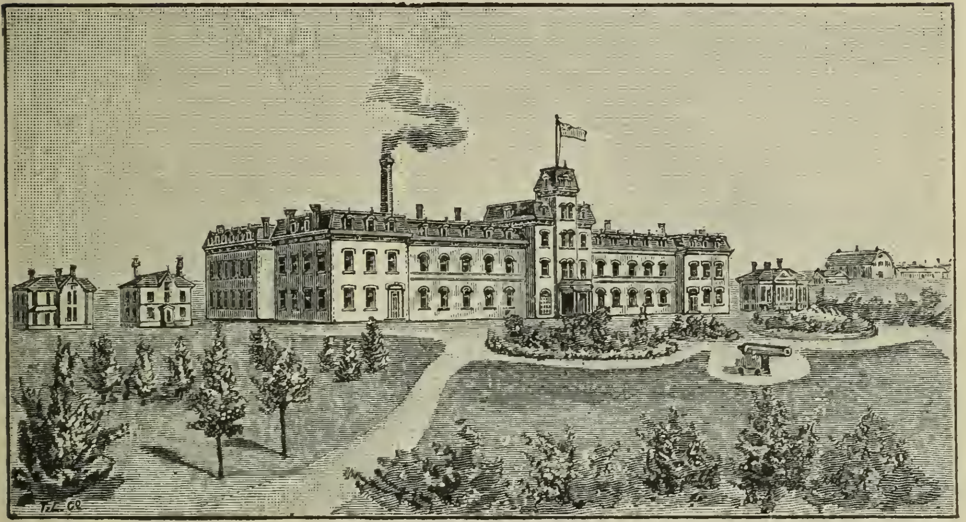

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BULLETIN XCVII.

EXPERIMENTS WITH WINTER WHEATS.

By C. A. Zavitz, B.S.A., Experimentalist.

This bulletin contains the results of the experiments in connection with the growing of winter wheat carried on at the Ontario Agricultural College during the past season.

There were 178 plots used for the winter wheat experiments in 1894, these being divided off as follows: variety tests, 102 plots; dates of seeding, 36; methods of seeding, 12; selection of seed, 8; quantity of seed per acre, 6; sowing spring grain to act as a mulch for wheat, 4; and harvesting at different stages of maturity, 10. As the variety tests have been conducted for five years in succession and the rest of the experiments for only one or two years, this bulletin treats more particularly of the varieties grown than of the methods of cultivation.

CONDITIONS OF SOIL.

The field upon which the grain was grown is a good average clay loam, quite uniform in character, and has a gradual slope towards the northeast. The size of all the plots used was $\frac{1}{100}$ of an acre, with the exception of those for different dates of seeding, in which case it was $\frac{1}{160}$ of an acre. The yields per acre have been calculated from the actual results of the plots. The land was prepared on the bare fallow system, and received a dressing of fifteen tons of farmyard manure per acre in the summer of 1893. No other fertilizer was used. Four crops had been removed from the land since it had received farmyard manure previous to last year.

CONDITIONS OF SEASON AND GROWTH.

Seeding took place early in September, and during that month 1.3 inches of rain fell, which was slightly below the average of the four years previous. The growth of the wheats in the autumn was good, and the amount killed out during the winter and early spring was small. April proved to be a very dry month, and May one of exceptionally wet weather; the growth of the wheat, however, was quite good throughout. The ripening of the grain took place between the 15th and the 23rd of July, which was fully three days earlier than in any of the four previous years. The trouble from both rust and smut was not serious this season.

Soon after the grain headed out, a storm caused the weak-strawed varieties to become considerably lodged, which interfered with the proper filling of the heads. To determine the effect produced by the lodging of the crop, an examination was made of four varieties, which were partly lodged about five weeks before the ripening season. From each of these varieties 1,000 heads were collected out of the standing grain and also 1,000 head out of the lodged portion of the crop. The sheaves were threshed separately and the results recorded, the following being the summary:

Condition of crop.	Weight of grain from 4,000 heads.	Weight of 4,000 kernels of grain.
	ozs.	drs.
Standing	121¼	82
Lodged	67	73

Providing the plants which lodged were equal in every respect to those which did not lodge,.these results go to show that the loss to the grain through lodging was about 4.5 per cent. in yield and 11 per cent. in quality.

VARIETIES.

This bulletin gives the particulars of 80 varieties of winter wheat grown in 1894 upon plots exactly similar in size and situated side by side. Paths three feet wide were left between the plots. Seeding took place on September 2nd with all the varieties excepting Nos. 56, 58 and 65, which were sown three days later, and No. 54, which was sown seven days later. The grain was sown by hand at the rate of 2 bushels per acre, and the land was then harrowed. The average yield in 1894 was superior to that of 1890, 1892 or 1893, but was not equal to that of 1891.

The following table gives the average results of the winter wheat tests for each of the past five years :

Year.	Number of varieties grown.	Average weight of grain per measured bushel.	Average yield of straw per acre.	Average yield of grain per acre. (bu. =60 lb.)
		lb.	tons.	bush.
1890	15	60.0	2.4	30.9
1891	23	63.3	2.0	52.9
1892	44	60.5	3.2	42.6
1893	52	58.4	2.1	29.9
1894	80	60.8	4.0	46.7

It will be noticed that the yield of straw per acre in 1894 was double that of 1891, and yet the yield of grain for 1891 was the highest of the five years. The order of the yield per acre for the five years is the same as that of the weight per measured bushel.

Characteristics and yields of eighty varieties of winter wheat.

Varieties.	Nature of head.	Color of grain.	Results for 1894.					Average results for number of years grown.		
			Date of maturity.	Per cent. of straw lodged.	Weight per measured bushel.	Straw per acre.	Grain per acre.	Weight per measured bushel.	Straw per acre.	Grain per acre.
GROWN FOR FIVE YEARS.					lb.	tons	bu.	lb.	tons	bu.
1 Early Red Clawson	*Ba	R	July 18	77	58.9	4.9	55.3	59.0	3.2	46.5
2 Surprise	Ba	W	20	35	59.2	3.7	48.3	59.8	2.9	46.0
3 Golden Drop	Ba	R	20	72	62.9	4.4	49.3	61.9	3.1	44.0
4 Red Velvet Chaff	Ba	R	22	62	58.0	5.1	49.3	59.5	3.2	42.8
5 Bonnell or Landreth	Ba	W	19	37	59.4	4.5	53.2	59.7	3.1	42.6
6 Standard	Ba	W	18	7	59.9	3.7	58.3	59.2	2.8	42.3
7 Golden Cross or Volunteer	Be	R	23	77	59.4	5.2	40.5	60.5	3.1	41.6
8 Rogers	Ba	R	23	67	59.4	5.0	43.0	60.4	3.1	41.5
9 Seneca or Clawson	Ba	W	19	55	59.7	4.3	53.0	59.6	3.0	41.0
10 Manchester	Ba	R	19	57	61.1	4.7	46.5	61.1	2.9	40.9
11 Martin Amber	Ba	W	24	57	60.9	4.4	49.1	60.6	3.0	40.6
12 Hybrid Mediterranean	Be	R	21	67	61.1	4.8	39.1	61.2	3.2	40.3
13 Lancaster	Be	R	19	92	60.7	4.8	42.5	61.7	3.2	39.1
14 Red Lion	Be	R	16	95	62.0	4.9	42.4	61.4	3.2	38.8
15 New Monarch	Ba	R	17	60	61.1	4.1	44.9	60.2	2.8	35.5

* The abbreviations mean : Ba, Bald ; Be, Bearded ; R, Red, and W, White.

Characteristics and yields of eighty varieties of winter wheat.—*Con.*

Varieties.	Nature of head.	Color of grain.	Results for 1894.					Avereage results for number of years grown.		
			Date of maturity.	Per cent. of straw lodged.	Weight per measured bushel.	Straw per acre.	Grain per acre.	Weight per measured bushel.	Straw per acre.	Grain per acre.
GROWN FOR FOUR YEARS.			July		lb.	tons	bu.	lb.	tons	bu.
16 American Bronze	Ba	R	17	0	61.3	3.7	52.7	59.7	3.1	48.4
17 Egyptian	Be	R	17	55	61.5	3.6	54.2	61.4	2.9	48.3
18 Jones' Winter Fife	Ba	R	17	7	61.0	3.9	59.6	60.6	2.6	47.4
19 Bulgarian	Be	W	17	42	62.0	3.9	53.9	62.3	2.7	45.6
20 Canadian Velvet Chaff	Ba	W	19	4	59.1	3.5	57.0	58.4	2.7	45.4
21 Garfield or Natural Cross	Ba	W	21	4	61.6	3.3	57.6	60.0	2.7	45.3
22 Winter Pearl	Ba	W	21	2	62.1	3.3	52.8	60.8	2.7	43.7
23 Democrat	Be	W	17	27	62.3	2.7	49.5	62.1	2.7	41.9
GROWN FOR THREE YEARS.										
24 Dawson's Golden Chaff	Ba	W	18	8	61.1	4.1	65.2	59.3	3.3	51.5
25 Reliable	Be	R	17	50	62.4	4.2	52.5	61.6	3.1	44.0
26 Russian Amber	Be	R	17	50	61.5	3.6	53.3	61.2	2.9	43.0
27 Walker's Reliable	Be	R	18	50	62.3	4.4	53.6	60.8	3.1	42.6
28 Valley	Be	R	16	32	61.9	4.2	55.6	60.7	2.9	41.8
29 Rumsey	Be	W	19	45	61.0	4.2	46.0	60.7	3.1	39.5
30 Rutherford	Be	R	21	50	61.1	4.9	42.1	59.7	3.5	39.1
31 Fultz	Ba	R	18	11	63.8	2.8	48.7	62.4	2.4	38.7
32 Genesee	Be	W	19	30	60.9	3.8	48.8	60.2	2.9	38.2
33 Mediterranean	Be	R	18	50	62.5	4.2	33.1	61.8	3.5	38.1
34 Hybrid Diehl	Ba	W	19	16	61.3	3.7	51.1	59.0	2.6	37.8
35 Monette	Ba	R	19	25	60.2	3.7	46.3	59.1	2.9	37.0
36 Manilla	Ba	W	20	11	59.3	3.6	49.4	57.3	2.9	36.7
37 Longberry Red	Be	R	18	92	60.4	4.2	41.0	60.5	3.1	36.5
38 Velvet Chaff	Be	R	16	0	63.6	3.0	40.5	62.4	2.5	35.7
39 Red Wonder	Be	R	21	50	61.1	4.8	31.3	61.7	3.6	35.3
40 Deitz Longberry	Be	R	20	16	62.2	3.2	25.2	61.9	2.8	34.7
41 Fulcaster	Be	R	19	47	60.8	4.8	29.4	62.2	3.2	34.4
42 Scott	Ba	R	19	42	60.1	3.4	44.6	59.6	2.5	33.3
43 Red Russian	Ba	R	21	0	61.9	2.8	40.3	59.8	2.3	29.9
GROWN FOR TWO YEARS.										
44 Early White Leader	Ba	W	22	15	57.9	3.6	57.2	56.2	2.7	43.6
45 South Sea	Ba	W	20	7	60.3	3.4	50.1	60.2	2.3	40.6
46 Soules	Ba	W	17	20	57.8	4.5	52.5	55.9	3.2	39.4
47 Eureka	Ba	W	17	17	58.1	3.6	47.2	57.1	2.7	37.4
48 Stewart's Champion	Ba	R	18	15	59.1	4.0	47.3	57.5	3.2	36.6
49 White Star	Be	R	19	20	60.1	4.0	44.5	59.5	2.5	34.8
50 Treadwell	Be	W	17	20	61.1	3.6	47.9	59.1	2.4	32.2
51 British Columbia	Ba	R	22	0	58.6	3.2	45.8	55.9	2.4	30.4

Characteristics and yields of eighty varieties of winter wheat.—*Con.*

Varieties.	Nature of head.	Color of grain.	Results for 1894.					Average results for number of years grown.		
			Date of maturity.	Per cent. of straw lodged.	Weight per measured bushel.	Straw per acre.	Grain per acre.	Weight per measured bushel.	Straw per acre.	Grain per acre.
GROWN FOR ONE YEAR.					lb.	tons	bu.	lb.	tons	bu.
			July							
52 Early Genesee Giant	Be	W	19	15	60.9	4.0	56.9	60.9	4.0	56.9
53 Early Ripe	Ba	R	21	42	61.5	4.2	55.1	61.5	4.2	55.1
54 Pride of Genesee	Be	R	19	40	60.5	3.8	51.4	60.5	3.8	51.4
55 Poole	Ba	R	16	42	61.6	4.0	50.7	61.6	4.0	50.7
56 New Columbia	Ba	R	16	15	58.2	4.0	50.1	58.2	4.0	50.1
57 Siberian	Ba	R	23	35	62.9	4.1	49.6	62.9	4.1	49.6
58 Rudy	Be	R	23	77	59.6	3.8	48.9	59.3	3.8	48.9
59 Red May	Ba	R	17	20	62.5	4.0	48.4	62.5	4.0	48.4
60 Jones' Square Head	Ba	W	19	0	60.3	3.2	48.3	60.6	3.2	48.3
61 Arnold's Hybrid	Be	R	16	22	62.2	3.9	48.2	62.2	3.9	48.2
62 Tasmania Red	Be	R	19	85	61.9	4.4	47.1	61.9	4.3	47.1
63 Turkish Red	Be	R	17	40	62.3	3.6	46.6	62.3	3.6	46.6
64 McPherson	Ba	R	18	30	61.9	3.9	45.1	61.9	3.9	45.1
65 Kentucky Giant	Be	R	16	70	58.4	3.9	45.1	58.4	3.9	45.1
66 Tuscan Island	Be	R	17	65	59.8	3.9	44.8	59.8	3.9	44.8
67 Hindostan	Be	R	21	45	61.5	4.0	44.5	61.5	4.0	44.5
68 Zimmerman	Ba	R	18	2	63.0	2.9	44.3	63.0	2.9	44.3
69 Egyptian Amber	Be	R	18	65	60.3	4.5	44.0	60.3	4.5	44.0
70 Imperial Amber	Be	R	21	90	59.0	4.9	43.4	59.0	4.9	43.4
71 Andrew's No. 4	Be	R	22	47	60.0	4.5	41.4	60.0	4.5	41.4
72 Emporium	Ba	R	23	45	58.0	3.9	41.2	58.0	3.9	41.2
73 Penquit's Velvet Chaff	Be	R	19	2	62.1	3.6	40.4	62.1	3.6	40.4
74 Geneva	Be	R	17	67	61.6	4.1	40.1	61.6	4.1	40.1
75 Bissell	Be	R	15	72	60.8	4.0	40.0	60.8	4.0	40.0
76 Simcoe Red	Be	R	17	60	57.0	4.3	38.3	57.0	4.3	38.3
77 Currell	Ba	R	16	40	61.5	4.2	37.2	61.5	4.2	37.2
78 Currell's Prolific	Ba	R	16	50	61.5	4.3	36.7	61.5	4.3	36.7
79 Bullard's Velvet Chaff	Ba	R	23	0	62.9	2.3	31.6	62.9	2.3	31.6
80 Golden Tankard	Ba	R	17	92	59.4	5.2	31.5	59.4	5.2	31.5

The results of the 80 varieties of winter wheat grown in 1894 are placed in tabulated form in such a way that the reader can compare the different kinds very easily. Starting at the left hand side of the table, columns 1 and 2 give the numbers and names of all the varieties; 2 and 3 refer to their characteristics; 5, 6, 7, 8 and 9 give results for 1894, and 10, 11 and 12 give average results for the number of years the varieties have been grown in the Experimental Department. The varieties are arranged in the order of their average yield per acre for the number of years grown, as indicated by the last column in the table, to which the reader's attention is especially directed. The great advantage of having the results of *all* the varieties here recorded is that any farmer may be enabled to compare the varieties with which he is not familiar with those which have been grown by himself or by his neighbors.

The following remarks are made upon the varieties which have given the largest yields of grain per acre for the number of years they have been grown on the plots:

Early Red Clawson. This variety gave the largest average yield of grain per acre, and also the lowest average weight of grain per measured bushel among fifteen varieties grown for five years. The crop is much inclined to lodge in unfavorable seasons, but when it stands well, the bald heads, red chaff, and white straw give this variety an attractive appearance when seen standing in the field. It will be remembered that the Early Red Clawson stood third in average yield per acre in the co-operative experiments over Ontario for 1893, at which time eleven varieties were tested.

American Bronze. The special feature of the American Bronze is that the crop usually stands well, while that of many other varieties becomes badly lodged. It is also a good yielder, and the average weight of grain per measured bushel for five years is nearly up to the standard. The chaff and straw are white, the heads bald, and the grains large, fairly long, and of an amber color. Among the eighty varieties of winter wheat grown on plots in 1894, the American Bronze was one of the finest looking at the time of harvest. I may add that this variety is somewhat subject to rust in unfavorable seasons.

Dawson's Golden Chaff. In yield of grain per acre, the Dawson's Golden Chaff takes the lead among all the varieties which have been tested at this station. In 1894 it gave 18.5 bushels per acre more than the average of the eighty varieties grown, and 5.6 bushels per acre more than the variety which stood next below it in yield. This wheat has been grown on the plots for three years, and leads in yield of grain among the forty-three varieties grown for that length of time. In the co-operative experiments over Ontario in 1893, when eleven varieties of winter wheat were tested, the Dawson's Golden Chaff not only gave the largest average yield of grain in the sixty experiments, but also headed the list in thirty-five out of sixty of the individual experiments. In three years trials, at the Experiment

Station, the Dawson's Golden Chaff stands exactly equal with the American Bronze in strength of straw, these two being the stiffest strawed varieties. The average weight of grain per measured bushel for the Dawson's Golden Chaff during three years is 59.3 lb., which is also exactly the same as the average of the fifteen varieties of white wheat grown for the same length of time. This variety is apt to rust in some seasons; but it has been quite free from smut at this place, although some trouble with smut in this variety is reported from one or two of the localities where it is now grown. The Dawson's Golden Chaff is quite distinct from any of the other varieties grown, and when ripe most closely resembles the Standard and the Clawson (white) varieties. The straw is medium in length, and the crop has a golden appearance. In 1894, it was grown on eleven plots in the Experimental Department, and on about four acres in the Farm Department; and was unanimously pronounced the most attractive variety at this station by five judges who examined the standing grain.

Early White Leader. Although this variety gave the largest average yield of grain for two years, among eight varieties grown on the plots in 1893 for the first time, the weight of the grain per measured bushel was the third lowest, among eighty varieties grown this season. It possesses long straw; long, bald heads; white chaff; and white grain of medium size.

Early Genesee Giant. This variety has been grown on the plots for two years, but, owing to the lateness of receiving the seed in 1892, the results were not reported the first year. It stood fourth in general appearance of standing grain, and seventh in yield of threshed grain, among eighty varieties grown this year. The straw is tall and fairly strong, the heads bearded and quite compact, the chaff red, and the grain white.

The above mentioned varieties have all been offered by leading seedsmen over Ontario for at least two years, with the exception of the Dawson's Golden Chaff which was not advertised in the seedsmen's catalogues previous to this season. In 1881 Mr. Robert Dawson, of Paris, Ont., had a field of the Seneca or Clawson in which he found one plant quite distinct and much superior to the rest of the crop. Mr. Dawson sowed the grain from this plant, and has continued to grow this wheat since that time. This variety has been extensively grown in the vicinity of Paris for the past few years; but it was practically unknown over Ontario until tested at the Experiment Station along with many old and new varieties, and the comparative results published.

The following table gives the average results of white and red wheats grown side by side for five years in succession :

Years.	Average results of white wheats.				Average results of red wheats.			
	Number of varieties.	Weight per measured bushel.	Straw per acre.	Grain per acre.	Number of varieties.	Weight per measured bushel.	Straw per acre.	Grain per acre.
		lb.	tons.	bush.		lb.	tons.	bush.
1890	5	60.1	2.3	30.3	10	59.9	2.5	31.2
1891	10	62.7	2.1	55.9	13	63.7	1.9	50.7
1892	15	59.6	3.2	40.0	29	61.1	3.2	44.0
1893	20	57.4	2.0	29.6	32	59.0	2.2	30.2
1894	22	60.3	3.8	52.4	58	60.9	4.1	44.5
Average ..	.....	60.0	2.7	41.6	....	60.9	2.8	40.1

In the above summary no separate classification was made for the amber, bronze and golden shades of color which are sometimes applied to winter wheat. These were included with the red wheats. The white wheats gave an average of $1\frac{1}{2}$ bushels per acre more than the red varieties, but the latter surpassed the former in weight per measured bushel of grain by nearly one pound.

The following table gives the average results of bald and bearded wheats grown side by side for five years in succession :

Years.	Average results of bald wheats.				Average results of bearded wheats.			
	Number of varieties.	Weight per measured bushel.	Straw per acre.	Grain per acre.	Number of varieties.	Weight per measured bushel.	Straw per acre.	Grain per acre.
		lb.	tons.	bu.		lb.	tons.	bush.
1890	11	59.9	2.3	30.6	4	60.1	2.7	31.7
1891	16	62.9	2.0	55.9	7	64.3	1.9	46.1
1892	24	59.6	3.3	40.2	20	61.6	3.2	45.5
1893	30	57.4	2.2	30.0	22	59.8	2.0	29.9
1894	42	60.5	3.9	48.7	38	61.0	4.1	44.4
Average ..	......	60.1	2.7	41.1	......	61.4	2.8	39.5

Varieties possessing very short beards are classified as bald wheats. The bearded varieties gave the heaviest weight of grain per measured bushel for each year, and the poorest yield of grain per acre for three out of the five years. The number of the bald and bearded varieties is about equal, while in the case of the white and the red grained wheats, the latter has more than double the number as compared with the former.

EXPERIMENTS OF WHEAT CULTIVATION.

Concise statements regarding the experiments in wheat cultivation.

Different Dates of Seeding. The average results for two years in sowing winter wheat on September 2nd, September 9th, and September 17th are slightly in favor of the middle date ; but, as the crop from the first sown grain was the most lodged in 1894, future experiments may give different results.

Methods of Seeding. By sowing winter wheat from all the tubes of a grain drill, the average yield per acre was 44.6 bushels ; from every second tube of a grain drill, 42.2 bushels ; and by broadcasting with the hand, 43.6 bushels.

Selection of Seed. Several experiments in the selection of seed grain were conducted, but they are too complicated to report in this bulletin. It might be mentioned, however, that in 1894 plump seed produced heavier grain than shrunken seed ; but the difference in the yield per acre was very small.

Different Quantities of Seed per Acre. Two varieties of winter wheat were each sown on small plots at the rate 1, 1½ and 2 bushels of seed per acre, and the average results show that the largest yield was obtained from the thickest seeding, but the best quality of grain was from the medium amount of seed. The proper quantity of seed to sow can be best determined by the various wheat growers themselves, as much depends upon variety of grain, fertility of the soil, etc.

Sowing Spring Barley in the Autumn, to Form a Mulch for Wheat in Winter. Two varieties of wheat were sown with and without spring barley on September 5th, 1893, and the results go to show that slightly better yields were obtained when the barley was not used.

Cutting Grain at Different Stages of Maturity. Two varieties of winter wheat which were considered about right for cutting by the 19th of July, were cut on July 4th, 11th, 19th, and 25th, and August 2nd. The heaviest grain was from the cutting on July 19th, and the largest yield of grain on August 2nd. The lowest results, in both these particulars, were from the first cutting.

CONCLUSIONS.

1 The average results of winter wheat grown on the experimental plots for five years in succession are as follows: Weight of grain per measured bushel, 60.6 lbs ; yield of straw per acre, 2.74 tons ; and yield of grain per acre, 40.6 bushels.

2. Among eighty varieties of winter wheat tested, the following have made high records : (1) Dawson's Golden Chaff ; (2) American Bronze ; (3) Early Genesee Giant ; (4) Surprise ; (5) Early Red Clawson ; (6) Golden Drop ; (7) Jones' Winter Fife ; (8) Bulgarian ; (9) Early Ripe ; and (10) Pride of Genesee.

3. The Dawson's Golden Chaff has made the best record of all the varieties of winter wheat tested in the Experimental Department.

4. Within certain limits, the amount of straw produced by a winter wheat is a poor indication of the yield of grain.

5. For five years in succession the bearded wheats gave a larger average weight per measured bushel, than the bald varieties.

6. The white wheats have given the best results in favorable years, and the red wheats in unfavorable years.

DISTRIBUTION OF SEED FOR TESTING PURPOSES.

In the subjoined table will be found the different sets of varieties of wheats, which will be sent free, by mail, in half-pound lots of each variety, to farmers applying for them, who will be able to test them carefully and report the results after harvest next year. The seed will be sent out in the order of the applications received, as long as the supply lasts.

Two Sets of Winter Wheat for Co-Operative Tests.

I.	II.
Dawson's Golden Chaff.	Dawson's Golden Chaff.
Early Red Clawson.	Early White Leader.
Jones' Winter Fife.	Early Genesee Giant.
Surprise.	Early Ripe.
American Bronze.	Pride of Genesee.

Each person wishing one of these sets should write to the Experimentalist, Agricultural College, Guelph, *mentioning which set he desires*, and the grain, with instructions for testing and blank forms on which to report, will be forwarded free of cost to his address, until the limited supply becomes exhausted.

SEED WHEAT.

The Dawson's Golden Chaff and American Bronze varieties of winter wheat were grown in the Farm Department in 1894. A limited quantity of these two varieties have been offered for sale this season at $1.00 per bushel, including bags.

The supply is now completely exhausted, owing to the large demand.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, ONT.

BULLETIN XCVIII.

IMPURITIES IN CLOVER SEED.

By J. H. Panton, M.A., F.G.S., Professor of Natural History and Geology.

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BULLETIN XCVIII.

IMPURITIES IN CLOVER SEED.

By J. H. Panton, M.A., F.G.S., Professor of Natural History and Geology.

Notwithstanding the advancement that has been made in the thorough cultivation of land by the farmers of Ontario, we find the number of species among weeds is on the increase.

This likely arises from a tendency among farmers to introduce seed from other places and not confine themselves for seed to the product of their own farms. Among the seed frequently changed, we may place clover, which on account of its size and form is very difficult to rid of impurities; on this account we may consider it as being a chief source of the introduction of weeds into many farms. The writer obtained sixty samples of clover seed from various parts of Ontario for the purpose of examining them in reference to their purity, cleanliness and vitality. These samples were obtained from wholesale seedsmen, seedsmen selling on commission, and from farmers. The results from an examination of these are interesting, as they show a marked difference in the number of weeds found in each.

In testing the samples three things were kept under consideration:

1. The *purity* of the seed; that is, the extent to which it was true to its kind.
2. The *cleanliness* of the seed; referring to its freedom from the seeds of weeds and foreign substances such as bits of stone, glass, etc.
3. The *vitality* of the seed with reference to its germinating power, when placed under favorable conditions.

Testing seeds for these three characteristics is now becoming quite a common practice among seedsmen of reputation, both in the United States and Canada; and thus we find almost invariably in connection with the wholesale seed houses a *testing-ground*, the presence of which has a great tendency to strengthen the confidence of customers.

In England and Germany the law demands seedsmen to guarantee the *vitality*, *purity* and *cleanliness* of the seeds offered for sale.

This has had a most beneficial effect upon the seed sold in those countries to farmers and gardeners, but it does not interfere with export trade, so that while great care may be exercised to sell a good article at home, yet a much inferior may find its way into our country. Much loss is sustained yearly from seed being not *true* to name, not *clean* and low in *vitality*, and as yet there seems no redress for the unfortunate purchaser in Ontario. It is claimed that most seedsmen are sufficiently jealous of their reputation to be a safeguard against imposition. This may be true to some extent, but it is feared there are many who run the risk of selling seeds they would not if they knew the law was ready to protect the unlucky purchaser. There is no doubt the use of "testing-grounds" by seedsmen has lessened the trouble very much.

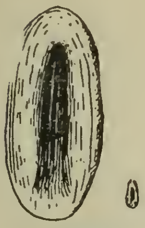
We would scarcely imagine that men would stoop to grind up quartz, sift and color it, so as to adulterate clover seed, and yet this has been conclusively shown to have been followed by some. Cases have occurred in which men have had hundreds of pounds of this spurious material sold to them in adulterated clover seed. Clover seed may be considered one of the most impure seeds in the market.

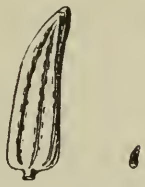
In making our observations, one-half ounce of the seed was taken from the sample obtained and the number of weed seeds, particles of sand, dirt, etc., carefully counted. The species of weed seed was also noted. One hundred seeds were tested for *vitality* by placing them in conditions favorable to germination, such as moisture, suitable temperature and darkness. The number that sprouted showed the per cent. vital.

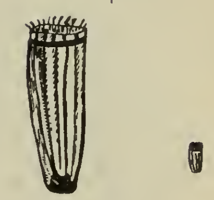
The vitality of seeds can be fairly well ascertained by placing seeds between sheets of blotting paper laid on sand, and keeping the paper moist. The samples should be kept where the temperature is not lower than that of the air. If it can be kept about 75° to 85° F. all the better. Some place the seeds on a piece of flannel and cover them also with flannel. The whole is placed in a saucer or plate, kept moist in a warm room and allowed to germinate. If one hundred seeds are used the number germinating indicates the per cent. vital.

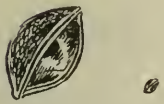
If seeds are scattered upon a piece of black cardboard the foreign grains, etc., can be readily detected.

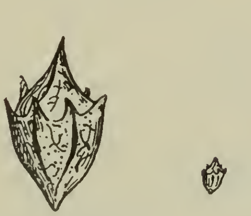
The following figures represent the forms of the seeds of some of the most common weeds, enlarged and natural size:

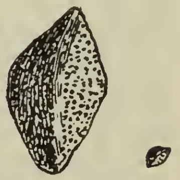

RIB-GRASS.

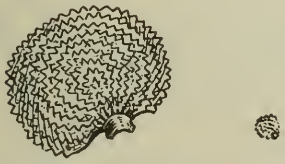

OX-EYE DAISY.

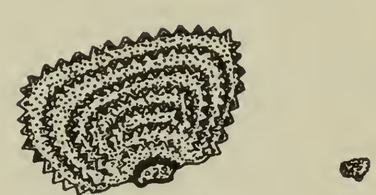

CHICORY.

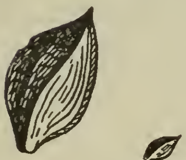

SORREL.

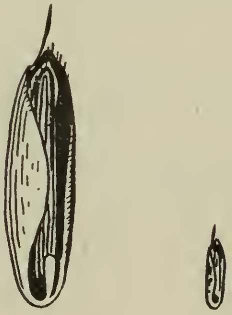

RAGWEED.


BINDWEED.


WHITE COCKLE.


BLADDER CAMPION.


BLACK BINDWEED.


CHESS.

The following tabulated statement gives in concise form the results of our examination of the samples obtained from sixty different sources:

Tabulated statement showing impurities in Clover Seed.

No.	Where from.	No. of weed seeds in ½ oz.	Other impurities, sand, etc.	Per cent. of weed seeds.	No. of weeds to clover plants in a square yard.	Kind of clover.	Vitality per cent.	Kind and number of weed seeds.									
								Grass.	White cockle.	Sorrel.	Campion.	Chicory.	Rib-grass.	Ragweed.	Smart-weed.	Chess.	Black bindweed.
1	Uxbridge	117	some	.58	4 —789	A	93	103	3	10	1						
2	“	135	much	1.44	10 —733	R	94	92	27	....	....	4	12				
3	“	420	“	2 1	17 —776	A	92	206	78	103	....	7	19				
4	Guelph	485	little	5.17	38 —705	R	90	273	61	72	....	5	61	3	....	10	
5	Lindsay	607	some	6.07	24 —769	A	93	550	24	....	....	26	....	....	....	....	7
*6	Toronto	......	clean	......	.. ..	R	95										
7	“	9	“	.09	.3 —792.7	A	95	7	2								
*8	“	6	“	.06	.4 —742.6	R	98	3	2	1							
9	“	30	some	.3	1 —792	A	96	21	9	6	....	4					
10	Guelph	47	little	.5	4 —739	R	92	25	7	12	3						
11	St. Marys	78	“	.39	3 —790	A	94	61	9	7	...	....	....	....	....	1	
*12	“	2	much	.02	.15—742.85	R	93	2									
*13	London	4	little	.04	.31—742.69	R	95	2	....	2							
14	“	64	much	.32	2.5 —790.5	A	96	40	12	....	....	....	12				
*15	Hamilton	4	clean	.04	.31—742.69	R	98	4									
16	“	57	fair	.28	2 —791	A	97	12	42								3
17	Toronto	168	some	.8	6 —787	A	91	100	56	...	....	2	....	....	....	2	S
*18	“	2	clean	.02	.15—742.85	R	94	2									
19	Bowmanville	4	some	.04	.31—742.69	R	94	1	....	3							
20	“	22	clean	.11	.8 —792.2	A	96	8	....	3	9	1	....	....	....	1	
*21	Toronto	4	“	.04	.31—742.69	R	97	1	....	1	2						
22	“	34	fair	.17	1 —792	A	87	14	....	11	9	....	....	....	....	1	
23	Waterford	16	“	.17	1 —742	R	90	4	4	5	3						
24	“	1824	clean	9.	72 —721	A	83	4	...	1820							
25	Simcoe	9	little	.09	.7 —742.3	R	79	....	....	9							
26	“	120	“	1.2	9 —734	R	89	4	....	116							
†27	“	4540	much	22.7	180 —613	A	49	....	....	4540							

28	St. Marys	748	little	3.7	29 —764	A	91	34	....	714							
29	Vaughan	540	fair	5.7	42 —701	R	89	....	....	....	...	....	540				
30	St. Marys	106	“	1.1	8 —735	R	87	85	....	12	1	2	..	....	5	....	1
31	Guelph	51	“	.54	4 —739	R	83	12	4	30	....	4	....	1			
32	Brantford	16	clean	.17	1 —742	R	83	5	....	6	...	2	....	....	....	3	
33	Guelph	4	some	.04	.31—742.69	R	87	4									
34	“	51	fair	.54	4 —739	R	90	28	....	10	13						
35	“	1712	much	8.5	67 —726	A	69	720	360	540	....	92					
36	Embro	2	clean	.01	.1 —792.9	A	93	2									
37	“	1	“	.01	.07- 742.93	R	93	.	....	....	....	....	1				
38	Woodville	6	“	.05	.4 —742.6	R	89	6									
39	“	36	“	.18	1 —792	A	90	4	32								
40	Huron County	43	fair	.45	3 —740	R	91	10	....	27	....	2	4				
41	“	765	much	3.8	30 —763	A	87	300	22	443							
42	Guelph	805	fair	4.02	31 —762	A	90	39	....	742	....	22	....	2			
43	“	36	clean	.3	2 —741	R	92	2	....	34							
44	Middlesex	14	much	.07	.5 —792.5	A	89	6	7	....	....	1					
45	“	8	“	.08	.61—742.69	R	84	8									
46	Kingston	16	“	.08	.61—793.39	A	65	....	15	....	....	1					
47	“	1	clean	.01	.07—742.93	R	97	1									
48	Bruce County	120	fair	.06	4 —789	A	89	63	15	39	.. .	3					
49	“	8	clean	.08	.61—742.39	R	94	5									
50	Oshawa	82	“	.82	6 —737	R	89	67	3	7	....	....	....	....	5		
51	Waterloo County	2	“	.02	.15—742.85	R	95	2									
52	Dundas	5	“	.05	.3 —742.7	R	93	3									
53	“	200	fair	1.	7 —786	A	84	22	....	175	....	....	....	3			
54	Russell County	15	clean	.16	1 —742	R	92	10	1								
55	Owen Sound	210	some	1.05	8 —785	A	82	160	30	18	....	2					
56	Guelph	55	fair	.27	2 —791	A	85	17	33	....	....	....	5				
*57	Toronto	1	clean	.01	.07—742.93	R	94	1	....	....	....	....	....	....	4		
*58	“	10	“	.05	.03—792.7	A	93	3	7								
59	Kingston	7	“	.07	.49—742.5	R	92	....	....	2	....	....	4	....	...	....	1
60	Toronto	15	“	.07	.5 —792.5	A	91	....	5								

1 lb. of alsike clover=640,000 seeds. 1 lb of red clover=300,000 seeds. Rate of sowing used in the above calculations: Alsike, 6 lb. to the acre; red clover, 12 lb. to the acre. Under the column “Kind of clover,” A indicates alsike, R red. *Nos. 6, 8, 12, 13, 15, 18, 21, 57, 58 were obtained from wholesale seedsmen. †No. 27, a sample as obtained from a farmer before cleaning. 117 weeds in ½ oz. alsike would give 22,464 weeds in an acre. 135 weeds in ½ oz. red clover would give 51,840 weeds in an acre.

Of the sixty samples examined, 53 contained grass seeds ; 27, seeds of white cockle (*Lychnis vespertina*); 32, sorrel (*Rumex Acetosella*); 8, Campion (*Silene inflata*); 17, chicory (*Cichorium Intybus*); 9, rib-grass (*Plantago lanceolata*); 4, ragweed (*Ambrosia artemisiaefolia*); 3, smartweed (*Polygonum Pennsylvanicum*); 5, chess (*Bromus secalinus*); 5, black bindweed (*Polygonum convolvulus.*)

CONCLUSIONS.

1. The number of seeds present is of more importance than their weight in determining the number of weeds.

2. The presence of weed seeds is far more serious than any adulteration from pieces of quartz, gravel, wood, etc.

3. It is a great mistake to buy cheap seed, as it is likely to possess poor vitality by being old and to contain the seeds of weeds. Seedsmen who sell pure seed require expensive machines to clean it, and therefore cannot be expected to sell their seed as cheap as those who take but little pains to have a good article.

Nos. 6, 8, 12, 13, 15, 18, 21, 57, 58 were obtained from wholesale seedsmen ; No. 27, a sample from a firm before it had been cleaned, while most of the others were from commission merchants or farmers.

4. Among the most common foreign seeds likely to be in clover are : Grass seeds, white cockle, sorrel, rib-grass, ox-eye daisy, chicory, smartweed, chess, black bindweed, false flax and thistle.

5. Every farmer should have a collection of the seeds of weeds. It would not be a difficult matter to collect a sample of each ; this would be of great assistance in identifying the seeds of weeds which might become a great pest.

6. Farmers should examine carefully all new seeds from other places. A very few weed seeds in half an ounce of seed will be thousands in what is required to sow an acre. See table.

7. The samples examined were quite true to name ; the vitality of the seeds was high, many reaching over 90 per cent. It is usual to deduct 8 per cent. from the laboratory test to represent the field vitality where conditions are not so favorable to germination.